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FRIDAY, JULY 9, 1897.

CONTENTS:

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE PHYSIOLOGY OF INTERNAL SECRETIONS.*

WE owe the term 'internal secretions' to Brown-Séquard,† by whom it was first used in published communications dating from 1891. The essential idea conveyed by the expression, however, is not new, as it has been stated more or less clearly by many previous writers in their speculations upon the probable functions of the so-called ductless or vascular glands. It had long been recognized that these glands possess no excretory ducts, and that, therefore, whatever secretion they may produce probably enters the blood either directly or by way of the lymph. Haller* is credited with stating this view with regard to the thyroid as early as 1776, and according to Pettit† a similar view was advanced by Schmidt in 1785 with regard to the suprarenals. Toward the middle of the present century this belief was generally accepted for such glands as the thyroid, suprarenals, thymus, hypophysis cerebri and spleen, but as early as 1869 Brown-Séquard seems to have suggested the view that all glands, whether possessed of excretory ducts or not, give off something to the blood that is of importance in the general nutrition of the organism. From 1889 his ideas took definite shape in numerous publications‡ upon the physiological effects of injections of extracts of the testis. At first he did not use the term internal secre-

*Paper read at the 4th Triennial Session of the Congress of American Physicians and Surgeons.

†Brown-Séquard and d'Arsonval: Comptes rendus de la Société de Biologie, 1891.

*Jones in Todd's Cyclopædia of Anatomy and Physiology: Article on Thyroid Gland.

†Pettit: Recherches sur les capsules surrén ales, 1896—Paris. Thèse de la Faculté des Sciences.

‡Brown-Séquard: Archives de Physiologie normale et pathologique 1889–92.

tion, and seems to have held the view, so far as the testis is concerned, that the material furnished to the blood is absorbed from the external secretion and is normally carried off in part in this secretion.

During this same period the brilliant results of the experiments made upon the thyroid glands and the pancreas were forcing themselves upon the attention of physiologists, and these results, together with his own experiments upon the extracts of testis and ovary, and his previously expressed belief as to the possible effect exercised by all glands upon the composition of the blood, seem to have led Brown-Séquard to the generalization expressed in the happy term 'internal secretion.' The term as used by him was not restricted to the glandular tissues alone, but was meant to signify that all the tissues in the body furnish something of special importance to the blood—that, in fact, every act of nutrition is accompanied by an internal secretion This broadening of the term to apply to all the tissues is logical, perhaps, but it must be admitted, I think, that so far as our actual knowledge goes it is not justifiable. The evidence derived from experimental investigations and clinical observations indicate that many, although not all, of the glandular tissues of the body as a result of their normal metabolism add something to the blood or affect its composition in some way, and that this activity is either essential or helpful to the maintenance of the normal functions of the organism. In this list we can place such glands as the liver, pancreas, thyroid and parathyroid bodies, suprarenal bodies, hypophysis cerebri, and probably the ovary, testis, thymus and spleen. But I know of no observations that force us to entertain a similar belief with regard to the non-glandular tissues, such as muscle, nerve and connective tissue.

So far as I am aware, there is no authorized definition of the term internal secretion, but, if we adhere closely to the facts in the case, the expression may be interpreted to mean certain products that are elaborated by gland cells from material furnished by the blood, which are afterwards passed back to the blood or lymph stream to subserve some function in general or special nutrition. From the standpoint of mechanism of secretion a useful distinction has been drawn between these internal secretions and secretions of the usual kind, or external secretions. The latter are in all typical cases poured out upon a free epithelial surface that communicates with the exterior, while the internal secretions are discharged upon the close endothelial surfaces of the blood and lymph vessels.

The definition given by Brown-Séquard, as we have seen, attributed internal secretions to all tissues. As a part of this general conception he was led also to restate what appears to have been a dream of the older physicians, namely, the view that all animal tissues might and ought to be employed in special cases as means of medical treatment, extracts of each organ or tissue being recommended for the particular disease supposed to be due to disturbance of function in the corresponding tissue. This general conclusion seems to have been a wide induction upon the basis of the incomplete facts known at that time with regard to the therapeutical use of extracts of thyroid and testis. It was not entirely justified by actual experience then or now, but the attractive possibilities it presents have doubtless been the cause of much of the general interest manifested in the subject of internal secretions. A new field, hitherto almost unexplored and full of promise for the discovery of medical specifics, seemed to be opened to the medical profession, and much activity has been exhibited in exploiting the possibilities of this kind of therapeutical treatment for

which the names *opotherapeutics*, *organotherapeutics* and *histotherapeutics* have already been suggested.

It must be borne in mind, however, that these promises are in large part premature. The one clearly successful method of treatment by animal tissues is the use of thyroid extracts, and the demonstration of the value of this method was the result of rigorous scientific work extending over more than a decade, and was obtained quite independently of the generalization announced by Brown-Séquard. It seems perfectly certain that whatever else of value may come out of the therapeutical application of tissue extracts must also be established by intelligent scientific research, on the side of experimental as well as clinical medicine, and not by indiscriminate and over-anxious attempts to secure immediate results.

It is my purpose to-day to call your attention briefly to some of the important results obtained by experimental physiology that tend to prove the existence of internal secretions in a number of glandular organs. The main interest to the physiologist lies, perhaps, in the light this work has thrown upon the functions of the blood-glands, or ductless glands, especially the thyroid, suprarenals, hypophysis cerebri, thymus and spleen. Forty years ago the physiology of these bodies was not only unknown, but was beyond the reach of intelligent hypotheses. Within recent years facts have accumulated, especially with regard to the thyroid and suprarenals, that give us a new standpoint from which to view their physiology—a standpoint also from which experimental investigations may be planned with reasonable hope of abundant success in the future. I shall not attempt an historical review of recent work in this subject, as this has been given already in numerous general addresses and special papers.* I desire only to emphasize what seems to be the outcome of the physiological work that has been done in the last twelve or thirteen years, and to explain briefly the character of the work now in progress.

If we include under the term 'thyroid tissue' not only the thyroid body itself, but also the accessory thyroids and the neighboring parathyroids, it has been shown beyond reasonable doubt that complete removal of this tissue in man and the related mammals is followed, as a rule, by serious disturbances of nutrition that are immediately or ultimately fatal to the animal. Moreover, in these cases the reintroduction of thyroid material into the body, whether this introduction be made by grafting the tissue, by subcutaneous or intravascular injections or by absorption from the alimentary canal, results in an amelioration or even entire removal of the symptoms of malnutrition. The physiologists recall with pleasure that these two fundamental facts were first discovered as the result of experimental work in physiology. The effects of complete thyroidectomy were first described by Schiff* in 1856, and the therapeutical use of thyroid tissue arose naturally from the grafting experiments of Schiff† in 1884 and the subsequent experiments of Vassale‡ and of Gley§ upon injections of thyroid extracts. The brilliant results that have followed the use of thyroid tissue in man in cases of myxoedœma, goitre, etc., are, too well known now to require more than a passing reference.

*See especially Abelous: *Revue générale des Sciences*, May 15, 1893.

Schäfer: Address in Physiology; Annual Meeting of the British Med. Assoc., London, 1895.

Meltzer: On Thyroid Therapy; *New York Med. Jour.*, May 25, 1895.

*Schiff: Untersuchungen über die Zuckerbildung in der Leber, etc., Würzburg, 1859.

†Schiff: Revue médicale de la Suisse romande, 1884.

‡Vassale: Rivista sperimentale di freniatria, etc., Vol. XVI.; also Centralblatt f. d. Med. Wiss., 1891.

§Gley: Comptes rendus de la Soc. de Biol., 1891.

It follows as a logical conclusion from the successful effects attending its therapeutical use, as well as from the evil effects of its destruction or removal, that the thyroid tissue produces, normally, something that is in some way essential to the nutrition of the body. What that something is has been revealed partially by the beautiful chemical and clinical researches of Baumann and Roos. Baumann * has succeeded in isolating a substance, thyro-iodin, or iodothyrin, as it has been named more recently, which, according to the experiments of Roos,† preserves the beneficial effects of thyroid tissue.

The chemical characteristics of this compound will doubtless be presented in Professor Chittenden's paper. It has proved to be a very stable compound, unaffected by boiling, by strong acids and by gastric digestion, and this fact may be taken as a complete disproof of a former view to the effect that the action exerted upon the body by thyroid tissue is due to the presence of special enzymes or ferments. The fact that extracts of thyroid tissue or iodothyrin when absorbed into the blood ameliorate or remove the evil effects resulting from loss of function of the thyroid, seems to prove at once that the normal function of thyroid tissues is not merely to excrete poisonous material from the blood after the manner of the kidneys. It indicates, on the contrary, that these tissues act normally by giving off a material to the blood that in some way affects favorably the nutrition of all or a part of the tissues of the body. In other words, the thyroid tissues form a true internal secretion. Histological research indicates that, so far as the thyroid bodies proper are concerned, this secretion is contained in the so-called colloidal material that accumulates in the interior of the vesicles, and that the mechanism of secretion consists in a rupture of the walls of the vesicles at some point whereby the contents are discharged into the surrounding lymph spaces.*

The most important fact that remains to be discovered is the manner of action of this secretion upon the tissues of the body. At present we can only speculate upon the answer to this problem. More experimental work is required before a definite solution can be reached. To account for the action of the thyroid secretion two main hypotheses have been proposed. According to one hypothesis the function of the secretion is antitoxic. In some way it antagonizes an unknown toxic substance supposed to be formed in the body in the course of normal metabolism. When the thyroid tissues are removed this poisonous material, being imperfectly excreted, accumulates in the blood and produces the fatal symptoms of thyroidectomy by a process of auto-intoxication. The other hypothesis assumes that the secretion of the thyroid acts normally by promoting or regulating the metabolism of other parts of the body, particularly, perhaps, of the nervous tissues. We might designate this as the trophic or neuro-trophic hypothesis. It is less specific than the antitoxic hypothesis, and therefore, perhaps, less objectionable in the present incomplete state of our knowledge; but as no decisive, or even probable, proof can be given for either view, it seems unnecessary to criticise the various facts brought forward in support of one or the other of them. The two great facts to be explained are: first, that complete removal of the thyroid tissues brings on a condition of malnutrition that seems to affect especially the central nervous system; and, second, that injection or ingestion of thyroid ex-

*Baumann: Zeitschrift für physiolog. Chemie, Bd. XXI., 1896; also Bd. XXII.

†Roos: Ibid Bd. XXII.

*Biondi: Berliner klinische Wochenschrift, 1888. Langendorff: Archiv für Physiologie, 1889, Suppl. Bd. Schmid: Archiv für mik. Anatomie, 1896.

tracts while the animal is in this condition restores its metabolism more or less completely to the normal state. While both of these facts are explicable in terms of either of the hypotheses mentioned, the trophic theory does not involve the somewhat strained assumption of an unknown toxic product of metabolism that can not be got rid of completely by the usual methods of excretion.

A very interesting phase of thyroid physiology that has recently come to the front is the nature of the functional relationship between parathyroid tissue and thyroid tissue proper, such as is found in the thyroid body and the accessory thyroids. The parathyroids seem to occur in all mammalia. According to a recent description by Kohn* there is always one of these bodies on each side attached to the external or posterior surface of the lateral lobes of the thyroid, while in some animals, *e. g.*, the dog, cat and rabbit, there is an additional one on each side, imbedded in the substance of the thyroid lobes. Histologically the structure of these small bodies bears no resemblance to that of the thyroid. They possess the general appearance of embryological tissue, and have, therefore, been regarded usually as an immature form of thyroid tissue, which, under the stimulus of increased functional activity, is capable of developing into normal thyroid structure. Satisfactory evidence is lacking that such a transformation does actually take place under the conditions supposed, as, for example, after complete excision of the two thyroid lobes. On the contrary, the evidence from histology, as well as from embryology, seems to indicate that the two tissues are not only fundamentally different in structure, but possibly are also different in origin.

On the physiological side Gley † was the first to prove the great importance of the parathyroids. He showed that in rabbits complete extirpation of the thyroid lobes alone is not followed by a fatal result so long as the parathyroids remain. Removal of both thyroids and parathyroids, however, is in most cases followed by typical symptoms of complete thyroidectomy ending in the death of the animal. This latter result has been contested by some observers, but renewed investigations have demonstrated its accuracy. Gley explained his results on the hypothesis that after removal of the thyroid its function is vicariously assumed by the parathyroids. He concluded, therefore, that the functional value of the two tissues is identical. Recent work, however, tends to throw doubt upon this conclusion. Vassale and Generali * state that in dogs and cats removal of all four parathyroids produces the acute symptoms of complete thyroidectomy, and finally causes the death of the animal, in spite of the fact that the thyroid body proper is left practically uninjured. On the other hand, complete removal of the thyroid lobes is not immediately injurious to the animal, provided the parathyroids—or, in some cases, if even only one of the parathyroids—are left. They contend, therefore, that the result in dogs and cats usually attributed to extirpation of the thyroids is due in reality to the simultaneous removal of the parathyroids.

This result is partly confirmed by the independent experiments of Rouxeau † and of Gley.‡ The former finds that in rabbits complete removal of the thyroids alone causes no trouble, at least no immediate trouble, while excision of the external parathyroids alone is followed frequently by death, or by convulsive symptoms. Gley

* Kohn : Archiv für mik. Anatomie, Bd. 44, 1894.

† Gley : Archives de Physiologie normale et pathologique, 1892.

* Vassale and Generali : Archives italiennes de Biologie, XXV. and XXVI., 1896.

† Rouxeau : Comptes rendus de la Soc. de Biologie, Jan. 9, 1897.

‡ Gley : Ibid.

reports some incomplete experiments upon rabbits and dogs that tend in the same direction. Finally, Moussu,* from experiments made upon mammals and birds, attempts to define in general terms the difference in function between thyroid and parathyroid tissue. According to his experiments, removal of the parathyroids alone is followed by certain acute troubles, such as have been usually described as the result of complete thyroidectomy, while removal of the thyroid lobes alone is followed by chronic troubles of nutrition which he designates as myxoedœmatous or atrophic cretinism. This last result has not been confirmed, so far as I am aware, by others, so that it cannot be accepted with entire confidence. It will be noted, however, that the tendency of this recent work is to show that the functional value of the thyroids and parathyroids is not identical, and that the importance hitherto attributed to the thyroids must be assigned, in part at least, to the parathyroids. The very great interest that these results may have when applied to human pathology and therapeutics will be evident to everyone.

Finally, a word may be said as to the possibility that other tissues exist in the body capable of replacing entirely or in part the functions normally performed by the thyroids or the parathyroids. This possibility seems to be indicated by the fact, commented on by most experimenters in in this field, that occasionally animals are found in which apparently complete removal of all the thyroid tissue, including the parathyroids, is not followed by a fatal result. Such cases may be explained by assuming the existence of accessory thyroids or parathyroids that escape the attention of the operator, but it is also possible that they may be due to the fact that there are other organs in the body that possess a thyroid function. Experiments in this direction have been made upon the spleen and the hypophysis cerebri. With regard to the former organ the results may be considered as entirely negative, while as regards the hypophysis the evidence is unsatisfactory. Some details concerning this last organ will be presented later.

The results of recent physiological experiments upon the suprarenal bodies have not been less interesting, although less complete than those upon the thyroid. These curious bodies, like the thyroid, are found constantly in all classes of the vertebrates, and seem, therefore, to be organs of fundamental importance. As long ago as 1856 Brown-Séquard* stated that extirpation of both suprarenals is usually fatal to the animal, death occurring generally very shortly after the operation, more rapidly, according to this observer, than after removal of both kidneys. This statement has been questioned frequently by other observers, but the results of the renewed investigations that have followed upon the recent revival of interest in the physiology of the ductless glands seem to corroborate fully the account given by Brown-Séquard. In the case of dogs, according to Szymonowicz,† death follows the operation within fifteen hours. It has been shown, also, that in some species of animals accessory suprarenals are not uncommon, and it is possible that this fact may explain the survival of a certain number of animals after supposed complete extirpation of the suprarenals. Removal of only one suprarenal does not appear to cause any noticeable trouble. In the case of complete removal, followed by a fatal result, the prominent symptoms preceding death are extreme muscular weakness, asthenia, and, in the case of dogs examined

* Moussu : Ibid, Jan. 16, 1897.

*Brown-Séquard : Comptes rendus de l'Ac. des Sciences, XLIII., 1856. *Journal de la Physiologie*, I., 1858.

†Szymonowicz : Archiv f. d. gesammte Physiologie, LXIV., 1896.

during this period, a great fall in blood pressure, together with a feeble heart-beat. It will be noted that in cases of Addison's disease in man the important symptoms, in addition to the pigmentation, are also an asthenic condition of the muscles and the heart. What explanation have we to offer for the surprisingly profound effect produced upon the body by the removal of these small organs?

Unquestionably, the most significant facts with regard to this problem have been obtained from a study of the effects of injections of suprarenal extracts into living animals. A number of the earlier experiments of this kind, especially those performed upon rabbits, resulted in the death of the animal, the preceding symptoms being convulsive movements, followed by some paralysis. The really valuable results, however, have been obtained by a more exact study of the effects of such injections upon the vascular and respiratory organs. Most of our knowledge upon these points has been derived from the researches of Oliver and Schäfer,* and Cybulski and Szymonowicz.† These two sets of investigators published their results nearly simultaneously. The important facts determined by them, and since corroborated in many laboratories, are as follows: Extracts of the medulla of the suprarenal bodies injected into the veins of a living animal cause a pronounced slowing of the heart-beat and a large rise of blood pressure. If the animal is first given atropin to paralyze the inhibitory nerves to the heart, or if the vagi are previously cut, the injection causes usually a marked quickening, instead of a slowing of the heart-beat, and a greater, indeed often an extraordinary, rise of blood pressure. The respiratory organs are not affected so seriously, a temporary slowing and shallowing of the respiratory movements being the result usually noticed. The effect upon the heart and blood vessels is quite temporary. Its exact duration depends somewhat upon the dose, and in part upon other less evident conditions, but, as a rule, within a very few minutes the rise in blood pressure, as well as the slowing of the heart-beat, passes off completely. New injections will bring out promptly a return of the effect described, although a continued repetition of the injections at too close intervals results in a progressive diminution of their action. Tying off the kidneys does not appear to prolong the effects of an injection, so that we may conclude that the temporary character of the result produced is not caused by a rapid elimination of the active substance through the kidneys, although, according to Szymonowicz, a part of it, at least, is got rid of by this means. The rapid disappearance, however, of the effects of a maximal or supramaximal dose indicates that the active substance is either quickly destroyed in the tissues or is neutralized in some unknown way.

The physiological explanation of the slowing of the heart caused by the suprarenal extracts offers no difficulties. Since this effect disappears completely upon section of the vagi, or after the injection of a few milligrams of atropin, it can only be due to a stimulating action upon the central endings of the inhibitory fibres, that is, upon the so-called cardio-inhibitory center in the medulla. According to Oliver and Schäfer the inhibitory effect is felt mainly upon the auricles. The beats of this part of the heart become weaker and slower and may cease altogether, while the ventricular beats, although slower, are more vigorous. After the vagi have been cut, suprarenal extracts cause a quicker and, according to Oliver and Schäfer, who measured the extent of

*Oliver and Schäfer: *Journal of Physiology*, XVIII., 1895.

†Cybulski and Szymonowicz: *Gazeta Lekarska*, 1895. (Abstracted in Jahresb. d. Thier-Chimie, 1895. Also Szymonowicz: Archiv. für d. gesammte Physiologie, LXIV., 1896.

the contractions directly, a stronger beat. This accelerating effect upon the heart after removal of the inhibitory fibres is not due, as we might at first suppose, to a stimulation of the central ends of the accelerator fibres, since it is still obtained after section of the cord in the neck, or after extirpation of the first thoracic ganglia. It must, therefore, be due to a peripheral action of the extracts upon the heart itself, either upon the muscle of the heart directly (Oliver and Schäfer) or upon the so-called motor ganglia (Szymonowicz, Gottlieb).

The effect of the injections upon blood pressure has been explained differently by those engaged in the work. Both Oliver and Schäfer, and Cybulski and Szymonowicz, believe that the enormous rise in blood pressure is due mainly to a great constriction of the arterioles. According to the latter this constriction is brought about by a stimulating action of the extracts upon the vaso-motor centers in the medulla and cord, while according to Oliver and Schäfer the action is exerted directly on the muscles of the blood vessels. Szymonowicz admits that if the cord is cut just below the medulla a great rise of pressure can still be obtained, but he explains this by supposing that the extract acts on the spinal centers. He asserts that if the entire cord is destroyed a rise of pressure can no longer be obtained. The experiment that he gives to illustrate this last point is, however, far from being convincing. The protocol of the experiment shows that the act of destroying the cord in itself reduced the blood pressure to zero. Moreover Biedl* reports that he has been able to get a rise in pressure from injection of the extracts after complete extirpation of the cord. The evidence, therefore, seems to favor the view proposed by Oliver and Schäfer, and this view is still further supported by the fact that when the volume of a limb is measured plethysmographically it often shows a distinct diminution after suprarenal injection, even though its nervous connections with the central nervous system are entirely severed.

There are, however, some facts reported in the experiments made by different observers which indicate that the assumed action of the substance on the peripheral arteries does not alone account for all the changes produced in blood pressure. It is probable that the greater force of the heart-beat plays an important part, as Gottlieb* contends, in causing the increase of arterial tension. Thus Szymonowicz reports measurements of the pressure in the external jugular vein made during one of his experiments. According to this report the venous pressure rose and fell with the arterial pressure, which is not what one would expect to occur in the case of a general constriction affecting the arterioles alone. According to Bayliss and Hill,† also, the general venous pressure increases with the rise in arterial pressure. So in a number of the published tracings given by Oliver and Schäffer it appears that the vaso-constriction was more pronounced in the abdominal viscera than in the limbs, since the volume of the latter measured plethysmographically showed an increase of a passive character, apparently, while the volume of the kidney or spleen was greatly diminished.

The significance of the marked reaction exhibited by suprarenal extracts depends very largely upon the possibility of proving that the substance producing the reaction is formed normally within the gland. It is conceivable, of course, that in the dead gland post-mortem changes might cause the formation of a substance giving this reaction, although under the normal condi-

*Biedl: Wien. klin. Wochenschrift, IX., 1896.

*Gottlieb: Archiv f. exper. Pathologie u. Pharmakologie, XXXVIII., 1897.

†Bayliss and Hill: *Journal of Physiolology*, XVIII. p 352, 1895.

tions of life it might not exist. Fortunately, we have direct proof that the active substance in question is a normal product of the metabolism in the gland. Cybulski and Szymonowicz found that blood drawn from the suprarenal vein, when injected into the circulation of a normal animal, gives the same effect, although less in amount, as extracts of the suprarenal glands, while blood from other veins has no such action. This result has been denied by Oliver and Schäfer, apparently upon insufficient experimental grounds. Langlois,* on the contrary, has been able to corroborate this effect of suprarenal blood, and, in the laboratory at Baltimore, Dr. Dreyer has obtained clear proof of a similar action. It appears from Dreyer's experiments that the effect is not obtained in every animal, but in some cases the results are very positive, and in a matter of this kind the positive evidence is the most important. When we remember that we are dealing most probably with a material formed by the secretory activity of gland cells, and that the amount of this material may vary at different times or under different circumstances, it is not surprising that negative as well as positive results are obtained.

Since it seems certain that the substance does occur under normal conditions in the venous blood flowing from the gland, we are justified in concluding that it is a normal product of the metabolism of the medullary cells of the gland, and that it is discharged or secreted directly into the blood. It must, therefore, exert continually a stimulating effect upon the heart and blood vessels. In corroboration of this last conclusion we have some striking experiments recorded by Szymonowicz which show that after complete extirpation of the two glands the blood pressure becomes greatly depressed. Both Oliver and Schäfer, and Cybulski and Szymonowicz, conclude that the normal function of the suprarenals consists in furnishing this stimulating substance to the blood. The former observers believe that its effect is mainly upon the muscular tissue; that it has a general tonic or augmenting action on all varieties of muscle found in the body—the striated muscle as well as the cardiac and plain muscle tissue. Cybulski and Szymonowicz hold essentially the same general view, except that they believe that the substance acts upon the nerve centers controlling the muscular tissues rather than on these tissues directly. It is, perhaps, impossible at present to decide as to this detail. Oliver and Schäfer have shown, without much doubt, that the substance acts upon the blood vessels after their connections with the central nervous system have been completely severed, and, on the other hand, there is clear proof that it affects at least one part of the central nervous system, namely, the cardio-inhibitory center. Further experimenting will probably soon furnish more definite information upon the extent to which the muscular and the nervous tissues are affected by this substance. Upon either of the views proposed we can understand at once why removal of the suprarenals brings on a condition of muscular asthenia, and why the continual activity of these organs is so essential to the body as a whole. It is significant, in this connection, to recall that Oliver and Schäfer found that extracts of the suprarenals in cases of Addison's disease did not contain this stimulating substance. The hypothesis that the suprarenals secrete a stimulating substance that augments the tone of the muscular system, either directly or indirectly, is not the only one offered to explain the physiology of these bodies. According to some observers the main function of the suprarenals, like that of the thyroids, is to produce an anti-

* Langlois: Archives de Physiologie normale et pathologique, 152, 1897.

toxic secretion capable of neutralizing or destroying certain poisonous products of body metabolism. The toxic products in this case have been supposed to originate in the functional metabolism of muscular tissue, and the asthenic condition following upon extirpation of the suprarenals has been compared with the similar effect produced by injecting the extracts of fatigued muscles into the circulation. The main argument of those who hold to this view seems to rest upon the fact that the blood of an animal that has been deprived of its suprarenals and is beginning to show the typical effects has a toxic effect when injected into the circulation of another animal from which the suprarenals have been removed shortly before. The fatal symptoms are brought on by the injection more rapidly than would happen otherwise. One cannot feel a great deal of confidence in this argument as contrasted with the apparently direct evidence offered in favor of the stimulation hypothesis.

Unfortunately, the physiological evidence with regard to the importance of the suprarenals to the body has not found so satisfactory an application in practical medicine as in the case of the thyroids. Suprarenal extracts and tissue have been used in cases of Addison's disease, but the beneficial effects obtained have not been so clear as in the case of thyroid extracts. Some of the results reported, however, indicate that the method is at least a hopeful one in certain cases.

A third interesting member of the group of ductless glands is the hypophysis cerebri, and a few words may be said as to its supposed physiological activity. This gland is commonly described as consisting of two parts, the anterior and the posterior lobe. The histology and the embryology of the two parts indicate that they are entirely different in origin and in structure. The anterior lobe is evidently a glandular structure. It develops originally as a saccular invagination from the buccal epithelium, and has essentially the same origin in all the vertebrates that have been examined. According to Haller* it is not strictly a ductless gland, since it possesses an imperfectly developed system of ducts that opens between the dura and the pia mater. It is evidently a secreting structure, and the fact that its secretion is discharged between the meningeal membranes suggests some special connection with the physiology of the brain. Histologically its structure recalls that of the thyroid gland, particularly in the fact that a colloidal material is said to occur frequently in the lumina of the gland tubules. In some animals, *e. g.*, the dog and the cat, it is a very small body, but in others, as the rabbit, sheep, ox and man, it is of considerable size and bears every indication in its structure of being an active secretory organ.

The posterior lobe, on the contrary, is very small in all animals and has the appearance of being a rudimentary organ. It develops as an outgrowth from the infundibulum of the brain and is more properly spoken of as the infundibular lobe. Its histology is very incompletely known. According to Berkley† it contains numerous typical nerve-cells, ependymal cells and neuroglia, a number of glandular epithelial cells arranged in part to form tubes or closed vesicles that contain a colloidal material, and some curious structures resembling nerve and organs.

The observations bearing upon the functions of the hypophysis have been limited to the glandular lobe. On the pathological side it has been shown that in many, if not in most, of the cases of acromegalia the glandular lobe exhibits pathological changes. For this reason extracts of the gland have been

* Morphologisches Jahrbuch, XXV., 1896.

† Berkley: The Johns Hopkins Hospital Reports, IV., 1895.

used therapeutically in cases of acromegalia, and, according to some reports, benefits have followed the treatment to the extent that some of the disagreeable features have shown amelioration. The evidence from this side, however, is not satisfactory, and the nature of the connection between acromegalia and disturbance of the function of hypophysis, if any exists, needs more complete investigation.

The experiments made by the physiologists are also meagre and inconclusive. Gley* reports a set of experiments made upon rabbits, in which he attempted to destroy the gland by an operation from above. The experiments were made upon rabbits from which the thyroid lobes had been removed previously, with the idea of demonstrating that a similarity in function exists between the thyroid and hypophysis. All but one of the animals died, owing to the severity of the operation. In the single survivor it was noted that the animal exhibited at times spasmodic muscular contractions and some degree of paresis, and that it died about a year after the operation. On the assumption that the animal would have lived if the thyroid lobes alone had been removed, Gley concluded that the removal of the hypophysis had prevented the parathyroids from replacing completely the loss of the thyroid, and that, therefore, the hypophysis is related in function to the thyroid tissue. Naturally but little importance can be attached to a single experiment of this kind, and, so far as I know, the author has not repeated the investigation. Vassale and Sacchi† claim to have removed the hypophysis partially or completely in a number of animals by an operation through the base of the skull. In cases of complete removal the animal died within a short time—fourteen days or less—after exhibiting a number of symptoms similar to those caused by thyroidectomy, such as muscular tremors and spasms and the development of a cachectic condition. Most physiologists, I fancy, will accept these experiments also with some hesitation until they have been confirmed by other observers. The very severe character of the operation necessary to reach the gland makes it questionable whether the results reported were due to its removal alone, although the experiments were evidently made with great care.

Szymonowicz and also Oliver and Schäfer report experiments upon the effects of injections of extracts of hypophysis into the circulation of normal animals. Szymonowicz states that in two experiments he obtained a slight fall pressure and a quickening of the heart-beat. He concludes, therefore, that the physiological action of these extracts is opposed to that caused by extracts of the suprarenals. Oliver and Schäfer, on the contrary, report that extracts of hypophysis exert an effect very similar in some ways to that shown by suprarenal extracts. For instance, they cause a marked rise of blood pressure, together with an augmentation of the heart-beat. Unlike the suprarenal extracts, however, they do not produce a slowing of the heart-rate when the vagi are intact. Upon the basis of these incomplete experiments they draw the somewhat hasty conclusion that the hypophysis and the thyroid are not similar in function, and that the hypophysis is not capable of assuming vicariously the activities of the thyroid.

I have recently made a number of experiments upon this organ, the results of which have been quite uniform and in many respects very different from those obtained by the authors just quoted. My experiments were made with the hypophysis of sheep mainly, although at first the gland of the dog was also used. The extracts were

*Gley: Archives de Physiologie normale et pathologique, 1892, 311.

†Vassale and Sacchi: Archives ital. de Biologie, XXII., CXXXIII., 1895; also XVIII., 1893.

made in normal saline, or in glycerine followed by dilution with normal saline, and usually the fresh gland was employed. The experiments differed from those reported by others, in that extracts were made separately of the glandular and the infundibular lobe, and the physiological effects of each were tested by injection into the circulation of normal dogs. It was found that the extracts of the glandular lobe have little or no perceptible effect when injected alone. Extracts of the small infundibular lobe, on the contrary, have a distinct and remarkable effect upon the heart-rate and blood pressure, an effect which resembles in some respects and differs in others from that shown by suprarenal extracts.

Briefly stated, these extracts injected into the normal animal with its vagi intact cause a very pronounced slowing of the heart-beat, similar to that caused by suprarenal extracts, but lasting a much longer time. The heart-beat is not only slowed, but is considerably augmented in force, as is shown by tracings taken with a Hürthle manometer. At the same time the blood pressure rises to a considerable extent, owing, apparently, to a peripheral constriction of the blood vessels, since oncometric tracings from the kidney show that this organ shrinks greatly in volume. Usually the constriction of the blood vessels occurs first, so that the pressure rises for about 20 mms. or more more of mercury. This is succeeded sometimes by a temporary fall of pressure during which the heart-rate may be increased, and then the slowing of the heart begins, while the pressure rises again to a greater or less extent above the normal. This last effect continues for a relatively long time and passes off gradually. The slowing of the heart may continue for half an hour or longer. If the dose used is a maximal one, and a second injection is given too quickly afterward, little or no effect is obtained. If, however, the dose is not too strong, and sufficient time is given given for its action to wear of, a repetition of the effects is obtained, and this may occur a number of times, although the effects decrease progressively in intensity.

The effects of the injection are somewhat different if the vagi are previously cut, or if a little atropin is given to paralyze the inhibitory fibres. Under these circumstances the slowing of the heart-rate is very much less marked, although not entirely lacking. In round numbers it may be said that with the vagi intact the heart-rate is reduced about 50 per cent., while in the atropinized animal the reduction is about 20 per cent. It might be added that an animal deeply under ether alone behaves in this respect like an animal with its vagi cut. This result indicates that the slowing of the heart-rate in the normal animal is due in part, but only in part, to a direct action on the medullary centers of the inhibitory fibres. On the other hand, the rise of blood pressure after section of the vagi is greater. Usually the blood pressure rises rapidly for about 20 mms. of mercury; this is succeeded in some cases by a temporary fall, and then the pressure again rises rapidly, reaching a height, in some cases, nearly equal to that caused by suprarenal extracts. During this last phase the heart-beats are slower and more powerful, the effect in this respect differing from that caused by suprarenal extracts. The effect lasts longer than with suprarenal extracts, and a longer interval must be allowed before a new injection will give the same result. I have obtained a marked rise of pressure from injection of extracts of the infundibular lobe, after severance of the cord below the medulla, and in one case after removal of most of the thoracic part of the spinal cord in addition, thus indicating that the constriction of the blood vessels is probably a peripheral effect, and not due to

stimulation of the vaso-motor centers. These observations that I present here only incompletely may be taken to indicate that the infundibular lobe of the hypophysis is, in all probability, not a rudimentary organ, but a structure that has some important physiological activity. Moreover, its function is probably different from that of the glandular lobe, and possibly quite independent of it. With regard to the function of the glandular lobe, the method of injecting extracts into the circulation of a normal animal seems to teach us nothing. While the negative results thus obtained do not oppose, they cannot be said to support, the favorite hypothesis that this part of the hypophsis cerebri has a function resembling that of the thyroid lobes. I venture to suggest that this supposed similarity in function might be tested most satisfactorily upon human beings by feeding the gland in cases of myxoedœma or goitre and ascertaining whether a reaction similar to that caused by the thyroid can be obtained.

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*ON THE RELATIVE VARIATION AND CORRELATION IN CIVILIZED AND UNCIVILIZED RACES.**

THE general conclusion would then be that, with increased civilization, absolute size† and variation tend to increase, while correlation, to judge by the males, is stationary; to judge by the females, tends to increase.

It will be found somewhat difficult to reconcile these results with any simple applications of the principle of natural selection. In the first place increased variation undoubtedly suggests a lessening of the struggle for existence, and there can be no question that this increase has gone on among civilized races (See 'Variation in Man and Woman'). The lessening of the struggle has probably been greater for woman than man; hence the principle of natural selection might help to explain the preponderance of variability in civilized woman. The increase in size with civilization seems, on the average, also incontestable. But is it the effect of lessening the struggle for existence? The possibilities may, perhaps, be summed up as follows:

(*a*) The civilized races may have survived owing to their superior size. It may be a result of the struggle in the past. To this must be objected that the increase of size appears to be a progressive change still going on, and yet increase of variation should show a lessening struggle for existence.

(*b*) The effect of suspending natural selection may be to increase size. This would be a blow for panmixia, for we might naturally have expected a regression to the smallness of the more primitive races. It would leave unexplained the apparently smaller progress of women as compared with men, for in their case we might argue from the variation that the struggle for existence is relatively less than in the case of man.

(*c*) The larger size of the civilized races may be due to better food supply and better physical training; in short, it may be due, not to evolution, but to better conditions of growth. This hypothesis does not involve the assumption that acquired characters are inherited. Diminish the food supply and abolish physical training, and the size would sink to the level at which natural selection had left it. Physical

*Conclusion of a communication made to the Royal Society.

†This is only *generally* true, not in every individual case. The French femur is longer than that of the Aino, of neolithic man, and of the ancient inhabitants of the Canary Islands. On the other hand, the French femur appears to be slightly less than the Libyan, although the humerus is somewhat greater. The French women appear in all long bones less than the Libyan women.

training in civilized races being usually more adequate in the case of man than of woman would, perhaps, explain why man has progressed more rapidly in size than woman. It seems impossible, taking variation as a measure of the intensity of selection, to reconcile the relative increases in size of man and woman with any direct effect of natural selection.

8. To sum up, then, the following results seem *suggested* by these measurements.

(i.) Civilized man has progressed generally on primitive man in size, variation and correlation.

(ii.) This progression can hardly be accounted for by increassd selection (because of the increased variation), not by decreased selection (because it is inconsistent with the relative changes in male and female size). It might possibly be accounted for by decreased selection and improved physical conditions.

(iii.) Woman is more variable than man in civilized races.

(iv.) Woman is more highly correlated than man in civilized races.

(v.) In uncivilized races the sexes are more nearly equal in the matter of size, variation and correlation than in the case of civilized races.

(vi.) It is impossible to say that civilized woman is nearer to the primitive type than civilized man, for while civilized man differs more from the primitive type than civilized woman, so far, probably, as absolute size is concerned, he has made only about half her progress in variation, and hardly any progress at all in correlation.

(vii) The causes (*e. g.*, lessening of selection) which tend to increase variation may also increase correlation. In other words, the intensity of the struggle for existence is not necessarily a measure of the intensity of correlation.*

The measurements made by Mr. Warren on the Libyans, the results of which he has kindly favored us with, are, on the whole, fairly in accordance with the above conclusions. He finds for the

Mean of the sexual ratio of the means	1.092
" " " the variations	1.028
" " " the correlations	1.068

The corresponding quantities for the French are: 1·109, 0·939, 0·956, or, we concluded, that in passing from uncivilized to civilized peoples, from Libyan to French, the men gain on the women in size—here very slightly, and the women gain upon the men very markedly in variation and correlation.

These results are merely suggestions, but they may possibly serve to emphasize the importance of a careful measurement of the long bones of, say, 100 members of both sexes for a series of civilized and uncivilized races. In the former case at least there does not appear to be any real difficulty, except the need of coöperation, in obtaining measurements similar to those of M. Rollet, for both English and Germans. The value of such statistics for comparative purposes would be very great.

Alice Lee,
Karl Pearson.

MIGRATION OF THINGS AND OF MEMORIES.

In the minds of some students the question of migration of forms is frequently confounded with that of the migration of tribes. It must not be forgotten by those who are carefully studying the origin of industrial forms on the Western World that there were daily mails delivered on the American shore from the Eastern Continent, from the remotest antiquity.

The United States Navy has been dropping bottles overboard in the Atlantic

* The mathematical theory of selective correlation shows that the close selection of an organ, say the femur, may actually tend to reduce the correlation between two other organs, say the humerus and the radius.

Ocean, at the Azores, in deep water along the coast of Spain and from the Madeira and the Canaries southward along the coast of Africa. All of these bottles that have been recovered have been found on the coast of South America, on the Antilles, and some of them as far west as the mouth of the Rio Grande. It can be inferred from this therefore, that every buoyant object which has been dropped into the ocean during the present geological epoch by prehistoric or historic Spaniards, Portuguese or Africans has found its way to America and been stranded somewhere between the 10th parallel south and the 30th parallel north.

In the northern part of the Atlantic Ocean the currents run the other way and the mails have been delivered from America to Europe. In the Pacific Ocean the daily mails delivered on the west coast of America from Mount Saint Elias southward have proceeded from about the 20th parallel north, in the vicinity of the Malay Peninsula and Archipelago, thence have travelled through the China Sea and the Japanese Sea to pick up objects designed for the Western Hemisphere.

In the Southern Hemisphere the mails travel the other way and materials consigned to the Ocean Current Company were taken from Chili and Peru to be delivered upon the Easter Island and the various groups of Polynesia, some of them reaching as far as Melanesia. In addition to these great mail services of the Pacific there was a narrow strip of service called the 'counter-current' between the equator and the 10th parallel north, the articles consigned to it being delivered on the west coast of Central America.

In the Arctic Ocean the mails proceeded from west to east, passing up through Bering Strait, across the Pole, and finding their way first to east Greenland and then around Cape Farewell to the southwestern shores of that great island. The Arctic current from Baffin Land and northward brought the mails from the Eskimo area southward even as far as Charleston, South Carolina. The consequence of such uninterrupted communication cannot be overestimated. All who have studied the arts of primitive races know how quickly their plastic minds respond to a congenial suggestion. It would not even be necessary for a Chinese or Japanese vessel to bring a single living teacher to take part in the pedagogic work of instructing the West Coast tribes in eastern Asiatic arts.

The recent example of a throwing stick which drifted from Port Clarence, south of Bering Strait, and was picked up on the shores of west Greenland by Dr. Rink, is one of an interrupted series of communications between one of those great mailing stations and another. A second element in technical pedagogy has not been emphasized by any modern writer, and yet it cannot be overlooked; and that is the survival of industrial processes and productions in the myths and traditions of wandering tribes, so that one of them having passed over a long area where a certain kind of activity was not demanded, and coming again to a place where the conditions are favorable to its revival, changed a song or an ancient tribal memory into an actual fact again.

O. T. MASON.

FIELD WORK OF THE UNITED STATES GEOLOGICAL SURVEY.

THE plans of operation of the United States Geological Survey for the fiscal year 1897–1898 have been approved by the Secretary of the Interior and the work of the field season of 1897 has been started, the parties having all taken the field. The sums appropriated for the Survey this year were given in detail in a recent issue of SCIENCE, separate amounts being set apart for specific branches of work and for the

salaries of persons connected with these branches, making the aggregate amount for the Geological Survey for the fiscal year 1897–'98 $967,840, a decided increase, though the additional sum does not go to the geologic branch.

For convenience in administration the work of the Survey is divided into four branches, each of which is again separated into a number of divisions. The branches are geology, topography, publication and administration; geology and topography being the main branches.

In geology the field work extends all over the United States from New England to the Pacific. Professor N. S. Shaler, of Harvard University, is at the head of a party which will continue the work begun last year of the survey of the Richmond coal basin of Virginia. Professor Walcott says in his report: "Although these Virginian fields are apparently remote from the New England region, the geologic problems are closely related to those which Professor Shaler has particularly studied, and it is convenient to continue the work under his direction." Professor Shaler has already completed the study of the Narragansett coal basin in Massachusetts and Rhode Island, and the publication of results has been begun; and a report on the Cape Cod geology is also proposed for publication.

A party under Professor Emerson is continuing his work of the last six years in studying the crystalline schists in eastern Massachusetts, and one under Professor T. Nelson Dale, in cooperation with Professor Wolff, will extend the work of previous years north and east to cover the area of the Bennington (Vt.) quadrangle. The study of the roofing-slate belt of New York and Vermont has been completed. Professor Kemp, of Columbia University, goes to the southeastern Adirondack area to work on the mapping of that section.

Professor J. E. Wolff will make a special study of the crystalline rocks of northern New Jersey, including zinc and iron ore deposits. He will also complete the survey of the Franklin (N. J.) quadrangle. He will also assist Professor Dale, as above mentioned. Mr. David White will study the coal deposits of Ohio, Pennsylvania, Virginia, West Virginia and Tennessee, from a paleobotanic standpoint, and Mr. M. R. Campbell will continue the study of the distribution of the coals of West Virginia and Kentucky. Mr. J. A. Taff will inaugurate work in the coal fields of Indian Territory. Dr. C. Willard Hayes' work in the southern Appalachian province has been brought to such a stage of development that he will prepare a monographic report upon it. Mr. Arthur Keith will continue the mapping of the crystalline rock areas in which he has been engaged, extending from the northern line of Maryland to North Carolina. His work is directed to an elucidation of the obscure geologic relations of the rocks of the Blue Ridge and Piedmont Plateau and their bearing upon geologic history.

Two parties will be sent to the Coastal plain region. One, under Dr. William B. Clark, of Johns Hopkins, will study the Cretaceous formations, which include the marl and clay beds of Maryland and New Jersey, and one under Mr. George H. Eldridge, who has been working for the past year on his report of the phosphate deposits of Florida, will spend the summer in the Atlantic Coast plain region.

Seven parties have been sent to the interior Mississippi region, and five to the Rocky Mountain region which lies between the British and Mexican boundaries on the north and south, the margin of the great plains on the east, and, approximately, the line of the 119th meridian on the west, and embraces the Rocky Mountains and their foothills. Mr. Arnold Hague is in charge

of one of these parties, which will do the field work necessary to enable him to complete his monograph on the Yellowstone National Park. This was interrupted by his work on the Forestry Commission of the National Academy of Sciences last year. Professor Hague will survey the Absaroka Range, one of the most rugged and inaccessible of the Rocky Mountains. Dr. W. H. Weed will continue the study of ore problems, etc., in Montana.

Mr. S. F. Emmons will be in Europe the greater part of the season, but under his direction surveys of the Tintic mining district of Utah will go on.

The Pacific region is covered by five parties, but the appropriation of $5,000 made for work in Alaska was not passed in in time to be available during the present year.

The paleontologic work is to be continued on the same lines as during the last year. "Special attention," says Professor Walcott, "will be given to the identification of certain fauna and flora in the coal regions of the Appalachians and the Rocky Mountains, and a thorough study will be made of the Cretaceous fauna of Colorado, Texas and Kansas, and the Tertiary fauna of California and Oregon, with relation to areal and vertical distribution, for the purpose of aiding the geologist in the solution of problems in areal geology. This will require that several members of the paleontological force shall continue field work, either independently or in connection with geologic parties."

It is also proposed to continue the collection and publication of data touching the mineral resources of the United States. Dr. D. T. Day has direction of this work, and $20,000 has been specifically appropriated for it.

One hundred and seventy-five thousand dollars has been allotted for topographic surveys proper and $150,000 for forestry surveys, and the plan of work will not be changed in character and organization from that of last year, except that additional work is imposed by the survey of the forest reserves.

The work of subdivision and topographic mapping in the Indian Territory is continued under C. H. Fitch, with the same organization as last year. Mr. Fitch expects to complete his field work by December 1st, with the exception of the resurvey of the Chickasaw Nation, for which $141,500 has been especially provided.

THE PHYSICAL SOCIETY OF LONDON.

THE Physical Society of London (or, as it is more generally called, the Physical Society) was founded in 1874 and was the outcome of a movement set on foot by the late Professor Frederick Guthrie, at that time professor of physics in the institution now known as the Royal College of Science. Among the original members of the Society were Professor W. G. Adams, Dr. Edmund Atkinson, Mr. Crookes, Professor Carey Foster, Dr. Gladstone, Professor Guthrie, Mr. Haddon, Professor John Perry, Professor A. W. Reinold and Professor Tyndall.

The purposes of the foundation were the receiving and discussing communications relative to physics, the exhibition of apparatus for physical research and of experiments illustrating physical phenomena and the publication of communications made directly to the Society and of other papers relating to physics.

Through his official connection with the Royal College of Science, Professor Guthrie was able to secure the consent of the Lords of the Committee of Council on Education, who are the authorities having jurisdiction in the matter, to the meetings of the Society being held in the physics lecture room of the College of Science and to the use of the physical laboratory and apparatus of the

College for the experimental illustration of papers read. The Society was thus relieved of all charges for rent of its meeting room and was consequently able to carry on its work without charging a larger subscription than one pound a year, or a single payment of ten pounds as a life composition for annual payments, with an entrance fee of one pound.

On this slender financial basis a very large amount of good work was done. Not merely were Proceedings issued containing the papers which had been presented to and accepted by the Society, but the works of Joule and of Wheatstone were printed in extenso and distributed to the members. Similarly were published in English Helmholtz's Memoir 'On the Chemical Relation of Electrical Currents,' Hittorf's Memoirs 'On the Conduction of Electricity in Gases,' Puluj's Memoir on 'Radiant Electrode Matter' and Van der Waal's Memoir 'On the Continuity of the Liquid and Gaseous States of Matter;' a useful work of reference by Mr. Lehfeldt entitled 'A List of the Chief Memoirs on Physics of Matter' and a table of 'Hyperbolic Sines and Cosines' by T. H. Blakesley.

The founders of the Society purposely avoided setting up a new journal, being of the opinion that the unnecessary multiplication of the sources to be consulted in search of scientific facts was a thing to be avoided. By an agreement with the proprietors of the *Philosophical Magazine* it was arranged that such of the papers read before the Society as the Council might decide to publish should, in the first instance, be printed in that magazine, and afterwards collected and issued to the members of the Society in the form of Proceedings. A large circulation was thus at once secured and the creation of an an additional physical journal avoided.

As the Society grew it became desirable that it should have a local habitation not far from the other leading scientific societies of London, and the Council were fortunately able to make arrangements with the Chemical Society, whereby since 1894 the meetings have been held in the rooms of the latter Society in Burlington House.

In 1895 the Proceedings of the Physical Society, which had hitherto appeared at irregular intervals, began to be published in monthly parts, and at the same time the Society began the publication of Systematic Abstracts of papers in Physics printed in foreign journals. It is hoped that these Abstracts will be of great use in facilitating a knowledge by English-speaking physicists of the work which is being done by their colleagues in other countries. The increased activity of the Society has involved an increase of expenditure, and to meet this it has been necessary to raise the subscription payable by members. At the present time the annual subscription is £2 and 2s.

The number of members is over 400 and and the list includes nearly all the leading physicists of the United Kingdom.

The Regulations of the Society provide for the election of a limited number of foreigners as honorary members, and in this way some of the most distinguished physicists in many countries are connected with the Society.

CURRENT NOTES ON ANTHROPOLOGY.

THE NATIVES OF THE PHILIPPINES.

It is well known that the Philippine Islands had when first discovered by Europeans two quite different classes of population. On the coast was a light colored race similar to the Malayo-Polynesians and speaking an allied dialect. In the interior was a small-sized, black race, called by the navigators 'Negritos.' In the Proceedings of the Prussian Academy of Sciences, 1897, No. XVI., Professor Virchow figures and describes a large deformed skull from a cave in the Archipelago, which, in its antiquity

and similarity to some others exhumed on other islands, suggests the probability that it comes from a prehistoric race, older than either of those mentioned, and perhaps not belonging among the Malayan stock.

With regard to the Negritos, Professor Virchow expresses the opinion that they are a 'primitive' type; at the same time he throws out various speculations on the rapidity and uncertain limits of variation in man, how much it arises from environment, etc, so that the reader almost expects him to say that originally the two types of the Philippines might have been one.

It should always be remembered that the so-called 'Law of Variation' in organic forms is a purely negative expression, formulating merely non-identity, and can have no other limits than those temporarily established by observation.

WAMPUM AND STONE MASKS.

PROFESSOR E. T. HAMY, well known for his numerous American studies, and now President of the Society of Americanists of Paris, has lately published two articles in the journal of the Society of considerable interest.

One is a description of a wampum belt believed to be of Huron manufacture, transferred, it is suggested, at the treaty made by Frontenac in 1673. A full examination of the beads and the method of boring would be desirable, in order to ascertain its antiquity.

The second paper is on a stone mask brought by M. Pinart from the Northwest coast. Its traits are allied to those of the wooden mask, but as an example in stone from that locality it is believed to be unique.

Another subject, to which Professor Hamy has devoted a short article in the *Compte Rendu de l'Academie des Inscriptions*, is a series of six ancient portraits of the Incas of Peru, of unknown provenance, discovered in an old house at Rochefort. They are especially interesting as showing the sumptuous official costume worn by the ancient monarchs of the Quichuas.

NATIVE AMERICAN ART-MOTIVES.

DR. H. STOLPE, of the Stockholm museum, Sweden, who probably stands at the head of European students of aboriginal art, has lately published an elaborately illustrated folio entitled 'Studies in American Ornamentation,' of which there is an extended notice in *Globus*.

He examines with patient care the art-motives of a number of tribes of North and South America. His investigations show that in nearly all examples the oldest decoration was anthropomorphic or zoomorphic. Emblems of the wind, the water, etc., also occur. A certain number are figured of which the interpretation is obscure.

Dr. Stolpe is severe on Hamy, Schurz and other modern writers who, in the face of well-known principles of scientific investigation, spend their time in seeking out analogies with the Old World in ancient American art. He has not found a trace of such cultural connection, and declares that wherever the material has been abundant all native American art-development can be proved to have been indigenous.

It is to be hoped that this work, which is in Swedish, will soon be translated into English.

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

NOTES ON INORGANIC CHEMISTRY.

As briefly noted in SCIENCE, fluorin has been at last liquefied. Professor Moissan, of Paris, brought all his apparatus for the production of fluorin to the Royal Institution, where he could avail himself of the

unrivalled appliances for the production of intense cold, as well as of the assistance of Professor Dewar. An account of the experiments is given in the *Comptes Rendus*, and with notes by Professor Crookes in the *Chemical News* of June 11th. The difficulties encountered in the liquefaction of fluorin are its intensely corrosive action and its very low temperature. Several liters of liquid oxygen, the refrigerant, were used in the research. Happily, at very low temperatures fluorin loses much of its chemical activity, no longer attacking glass. Fluorin becomes liquid at —185° C., is clear yellow and possesses great mobility. At this low temperature silicon, carbon, sulfur, phosphorus and reduced iron previously cooled in liquid oxygen and then placed in an atmosphere of fluorin, do not become incandescent, and the iodin of potassium iodid is not displaced by fluorin. Benzene and turpentine are, however, decomposed with incandescence when the temperature rises to —180 C., showing the great affinity of fluorin for hydrogen. Note is made of the fact that when fluorin is passed through liquid oxygen a white flocculent precipitate is formed, which when filtered off deflagrates with great violence as soon as the temperature rises. It would seem to be a compound of fluorin and oxygen, and is being further investigated.

In a recent *Comptes Rendus*, Berthelot and Vieille give an account of further investigations on the dangers attending the storage of acetylene. They had previously shown that, if under less than two atmospheres pressure, acetylene cannot be detonated by fulminates or by red-hot wire. They now show that acetone is a good solvent for acetylene. While such a solution is still capable of explosion, it is much safer than the gas alone, and the pressure at which an explosion is possible is raised from two to ten kilograms per square centimeter. In a large vessel the amount of acetylene that can be safely stored is fifty times greater with the acetone than without it.

At the conference of the Institution of Civil Engineers, held in London the last of May, Professor Biles read a paper before the Shipbuilding Section on 'Improved Materials of Construction.' In the course of the discussion which followed it was strongly brought out that nickel steel is the coming material for ship building, provided its cost can be made satisfactory. For this, it was said that new deposits of nickel must be discovered and the cost of its metallurgy must be reduced.

The *Engineering and Mining Journal* gives a report of the Carborundum Company for 1896, by which it appears that the output of crystalline carborundum for last year was nearly six hundred tons. It seems probable that the amorphous carborundum formed in the manufacture, which has heretofore had no use, will ultimately displace ferro-silicon in the manufacture of steel. Germany alone would use 2,500 tons of carborundum annually if it could be furnished at not over six cents a pound, and the Carborundum Company claims it can do this.

J. L. H.

SCIENTIFIC NOTES AND NEWS.

We are informed that the preliminary programs for the meetings of the sections of the American Association for the Advancement of Science promise many interesting papers and a large attendance. No less than twenty-five papers have already been entered to be read before the physical section, including contributions from a number of leading physicists, and other sciences will be equally well represented. We hope to publish in advance of the meeting the full programs for all the sections.

The fourth summer meeting of the American Mathematical Society will be held, as we have already announced, at Toronto, Canada, on Monday and Tuesday, August 16th and 17th.

It will thus immediately follow the adjournment of the American Association for the Advancement of Science from Detroit to Toronto, and immediately precede the opening of the Toronto meeting of the British Association for the Advancement of Science. The committee of arrangements announce that by invitation of the University of Toronto the Society will meet in the main building of the University. The Society will be called to order by the President, Professor Simon Newcomb, on Monday morning at 10 o'clock, and the Council will meet Monday evening. The committee has decided to set apart one of the sessions during the meeting for the general discussion of the following subjects: (1) The accurate definition of the subject-matter mathematics. (2). The vocabulary of mathematics. The possibility of correcting and enriching it by cooperative action. In connection with the former of the subjects, reference may be made to the Presidential address of Mr. A. B. Kempe before the London Mathematical Society (Proceedings of the London Mathematical Society, Vol. 26, pp. 5–15). No special railroad rates to and from this meeting have been secured, but members are entitled to special rates for the numerous excursions arranged in connection with the meeting of the British Association. Members may join the British Association on payment of five dollars. Members of the American or of the British Association secure reduced rates to and from the meeting through those bodies.

MR. C. L. MARLATT, Secretary of the Association of Economic Entomologists, writes us that the annual meeting of the Association for 1897, which was announced for the two days preceding the general sessions of the American Association for the Advancement of Science at Detroit, viz., August 6th and 7th, has arranged for its sessions on Thursday and Friday, August 12th and 13th, during which time Section F will hold no meetings, closing its work on Wednesday, the 11th. It is believed that this arrangement will give better satisfaction to the members of the Association of Economic Entomologists, most of whom are also members of Section F, and will be a saving of time. The Russell House will be headquarters. A new feature of interest which will be introduced this year will be reports from various foreign members of the Association on the worst insect pests of the year in their respective countries. The titles of papers should be sent promptly to the Secretary to be inserted in the provisional program. General information relating to hotel accommodations, railroad rates, etc., is given in the preliminary announcement recently issued by the American Association for the Advancement of Science, and, if any of the members have not received this circular, they may obtain it, or any other desired information of similar nature, by writing to the Local Secretary, A.A.A.S., Mr. John A. Russell, 401 Chamber of Commerce, Detroit, Mich.

AMONG the very numerous jubilee honors conferred by Queen Victoria we notice that Sir William MacCormac, President of the Royal College of Surgeons; Dr. Samuel Wilks, President of the Royal College of Physicians, and Mr. James Pender, who carries on much of his father's work in connection with telegraphs, have been made baronets. Professor William Crookes, Dr. W. G. Gowers and Dr. Felix Semon have been made knights. The K. C. B. has been conferred upon Professor J. Norman Lockyer, Dr. William Huggins, Mr. J. Wolfe Barry and Dr. Edward Frankland, and the C. B. on Mr. W. H. M. Christie, Astronomer Royal.

YALE University has conferred the degree of LL.D. on Dr. T. Mitchell Prudden, professor of pathology in Columbia University.

HARVARD University has conferred the degree of A.M. on Professor Franklin W. Hooper, of the Brooklyn Institute of Arts and Sciences.

TRINITY University, of Toronto, will confer, at the approaching meeting of the British Association, the honorary degree of D.C.L. on Sir John Evans, President; Lord Lister, Lord Rayleigh, Sir John Lubbock and Dr. Forsyth.

MR. ERNEST B. FORBES, of the University of Illinois, has been appointed Assistant State Entomologist in Minnesota.

F. V. COVILLE, Chief Botanist of the Department of Agriculture and Curator of the National Herbarium, has just gone to Oregon, to investigate the effect of sheep herding on the vegetation of the Cascade Range, and to conduct botanical investigations.

A DISPATCH to the London *Times* states that Lieutenant Eldred Pottinger and Mr. Lawrence, who, with a small party of Gurkhas, have been engaged for some months past in exploring the sources of the Irawadi, were attacked by Black Mairus on the night of May 22d. A native surveyor and one Gurkha were killed, and two Gurkhas were wounded. Lieutenant Pottinger and Mr. Lawrence escaped with the rest of the party, bringing the wounded men with them, and after great hardships arrived in Chinese territory.

THE death is announced of Dr. Japetus Steenstrup, formerly professor of zoology at the University of Copenhagen, and known for his contributions to natural history and paleontology, at the age of eight-four.

THE trustees of the National Portrait Gallery, London, have purchased a portrait of Sir Joseph Richardson, sometime British Secretary of State and the second President of the Royal Society. The Gallery has received by presentation a portrait of Francis Ronalds, one of the inventors of the electric telegraph, and a bust of Richard Jeffries, naturalist and author.

A BRONZE statue of Benjamin Franklin, representing Franklin seated in heroic proportions, will be presented to the City of Philadelphia by Mr. Justice C. Strawbridge and erected on the spot where Franklin laid the cornerstone of the first building of the University of Pennsylvania.

THE committee on an international memorial to the late Sir John Pender, whose appointment we announced some time since, has already received subscriptions amounting to about £6,000. It is proposed to place a bust of Sir John Pender in some suitable institution, to endow with £5,000 a Pender chair of electrical engineering in University College, London, and to establish a Pender scholarship and a gold medal at Glasgow University.

MR. JOHN RUSSELL YOUNG, a newspaper correspondent, not known to have made any study of library management or methods, has been appointed by President McKinley head of the new Congressional Library. Mr. A. R. Spofford will remain connected with the library as First Assistant Librarian. Mr. Bernard R. Green, who, with the late General Thomas L. Casey, supervised the construction of the library building, has been appointed Superintendent of the Buildings and Grounds.

SECRETARY SHERMAN has, under an authorization in the recent sundry civil appropriation bill, changed the title of the Bureau of Statistics of the State Department to that of Bureau of Foreign Commerce. The old title tended to confusion with other bureaus and did not properly describe the work of the bureau, which deals with the collection of reports of consular officers on foreign commerce and their distribution to the business community.

A COMMITTEE has been appointed by the Treasury Department to make an investigation of the U. S. Coast and Geodetic Survey, with a view to learning whether the efficiency of the department, especially its field work, can be improved. Professor W. G. Reymond, of the Rensselaer Polytechnic Institute, and Mr. Octave Chanute, of Chicago, have been appointed members of the committee, one place remaining to be filled.

THE New York Zoological Society has begun the publication of a *News Bulletin*, intended to increase interest in the work of the Society. The first number contains, in addition to items of news, an illustrated articles on the Zoological Park, reprinted from *Harper's Weekly*. The Society proposes to hold, next winter, an exhibition of paintings and sculptures of American wild animals. The plan for the grounds and buildings of the park will soon be completed.

THE specifications for the new wing of the American Museum of Natural History, New York, have been approved by the Park Board, and bids for the building will soon be opened.

THE Natural History Building of the University of Illinois was struck by lightning on the morning of June 17th, and partially destroyed. The collections, apparatus and libraries of the Illinois State Laboratory of Natural History, the Biological Station and the Agricultural Experiment Station were saved, with slight damages by water. The damage to the building is estimated at $3,000. The loss in apparatus, principally in geological and botanical departments, is nearly $5,000.

THE steamship Hope, commanded by Captain John Bartlett, has been again chartered by Lieutenant Peary, who will leave Boston to join the steamship between July 10th and 12th.

THE daily papers state that additional details of the eruption of the Mayou volcano, in the Province of Albany, Philippine Islands, show that 120 of the inhabitants of the village of Liboug perished. The village was greatly damaged and the tobacco crop of the vicinity was destroyed. The eruption was accompanied by an earthquake, the shocks being felt over an area of one mile. The volcano of Mayou has not been active since 1617.

THE third session of the Greenacre lectures opened on July 1st and will continue until September 3d. Daily lectures are given on subjects of scientific, literary and philosophical interest. The congress will take advantage of the meeting of electrical engineers at Greenacre and announces as part of the program lectures by Professors Barker, Brackett, Duncan, Crocker, Pupin, Cross and others.

THE International Institute of Bibliography at Brussels announces the holding of its second conference, August 2–4, 1897.

THE *American Journal of Archæology*, hitherto edited by Professor A. L. Frothingham, Jr., has been transferred to the Archæological Institute of America, and will hereafter be published in a second series by the Macmillan Company. Professor John H. White, of Harvard University, will be the editor-in-chief, with Professor James R. Wheeler, of Columbia University, and Professor Allan Marquand, of Princeton University, as assistant editors.

DR. PERSIFOR FRAZER, who, at the wish of the late Professor Cope, has been for two months acting as managing editor *pro tem.* of the *American Naturalist*, has been succeeded temporarily by Mr. A. M. Brown, of Philadelphia.

Natural Science calls attention to the fact that over a century ago there was founded a zoological record, viz., F. A. A. Meyer's *Zoologische Annalen*, which was published at Weimar in 1794, and ran for one year only. Meyer gave an account of zoological works issued up to Easter and up to Michaelmas, 1793, an aphabetical list of all living zoologists, an account of all the zoological collections known to him, and a sketch of all the new animals described during the year, in systematic order.

MR. A. W. BENNETT will succeed Professor F. J. Bell as editor of the Journal of the Royal Microscopical Society.

A *Zeitschrift für comprimirte und flüssige Gase*, edited by Dr. M. Altschul, will herefter be published in Berlin by L. Esterman. The first number was opened by an article by Professor Raoul Pictet, followed by articles by Professor H. F. Wiebe and Professor M. Thiesen.

IT is noted in *Industries and Iron* that according to a recent American Consular report, at a place called Tongshan, about eighty miles from Tien-tsin, the Chinese have established extensive railway carriage building works, in which the rolling-stock for the extension of the railway is being constructed. Only the axles, wheels, springs and couplers are imported, and the Consul expresses himself as surprised at the excellence and finish of the passenger carriages turned out by native labor. The Chinese Engineering and Mining Company have attained an output of 2,000 tons of coal daily from the mines in the vicinity, and large extensions are being contemplated.

WE have already announced that next year Captain Sverdrup proposes to take the Fram up Smith Sound to the northwest coast of Greenland, for the purpose of prosecuting explorations in that direction. The London *Times* states that, though Dr. Nansen will not accompany the party, there is reason to believe that he is taking an active share in the direction of the expedition. The object will be to penetrate north through Smith Sound and Robeson Channel as far as possible along the northwest coast of Greenland. An attempt will be made to discover how far Greenland extends northward, and to survey the northwest, north and northeast coasts. In short, one prime object will be to complete the exploration of the Greenland coast, a considerable extent of which is still quite unknown. It will be remembered that Lieutenant Peary carried explorations further eastward than had been previously

done. The task will be a difficult one, even if Captain Sverdrup succeeds in taking the Fram through the difficult ice navigation which is generally found between the Greenland and American shores. Still, as we know from Hall's experience, there are years when the passage is quite clear, and if the conditions are favorable the Fram may succeed in reaching 82° N. without difficulty. Dr. Nansen is also anxious that Captain Sverdrup should examine what has been called the 'paleo-crystic ice,' about which there has been so much discussion, and as to the origin and real character of which there is considerable doubt. An attempt will be made to discover how far one must travel from land with dogs and sledges before meeting with ice more like that in which the Fram drifted.

Commissioner Herrmann, of the General Land Office, has formulated, for the approval of the Secretary of the Interior, Regulations for the Forestry Reserves of the United States, following the recommendations of the Committee of the National Academy, published in a recent issue of this Journal. Attention is called to the danger of forest fires and to the law providing for punishment by fine or imprisonment, not only for willfully setting fire to any timber on the public domain, but also for letting fires burn unattended near any timber. The recommendations would allow prospecting and the development of mineral resources, and land for school houses and churches are provided. The construction of wagon roads and irrigating canals is permitted. The pasturing of live stock is allowed, except of sheep in regions where the rain fall is limited. Owners of mines and settlers resident within the forest reserves are permitted to take firewood, fencing and building material when they have not a sufficient supply on their own claims. Provision is also made for the sale of timber when this will not interfere with the value of the forests. Instructions are issued to all special agents of the Interior Department regarding the prevention of injury and depredations. It is further provided that lands more useful for mining or agricultural purposes may be eliminated from the forest reserves and restored to the public domain. Subject to the surveys now being made by the Geological Survey, portions of the suspended reserves may be restored to public entry, and other portions of the public domain may be included in them.

An article in the London *Times* entitled 'On the Trail of a Ghost,' regarding an alleged haunted house in Perthshire, Scotland, has been followed by numerous letters on the subject. Two of these, one by Professor John Milne, offer the plausible explanation that the noises are of seismic origin. Perthshire is a center for British earthquakes. As early as 1840 the British Association appointed a committee to investigate the Perthshire earthquakes, and instruments were established in the parish church at Comrie. As many as 465 shocks were noted there between 1852 and 1890, and sounds may be heard when no movement can be either felt or recorded by an ordinary seismograph. Mr. Milne suggests that "The Society for Psychical Research when on bogey-hunting expeditions might possibly find that the suggested use of tromometric apparatus might not only lay home-made ghosts, but would furnish materials of value to all who are interested in seismic research."

We learn from *Industries and Iron* that the Lachine Rapids, Hydraulic and Land Company, organized in 1895, to use the great energy of the Lachine Rapids, near Montreal, will soon complete its installation. There will be about eighty-six turbine wheels shortly in operation, and twelve dynamos making 175 revolutions each with a generating pressure of 4,400 volts. The electric energy will be carried by overhead wires as far as the outskirts of Montreal, and then passed underground until it reaches the substation in the city.

The supply bill passed at the recent session of the New York Legislature contained an item appropriating $10,000 for the medical department of the University of Buffalo to investigate the causes, nature and treatment of cancer. Governor Black vetoed this appropriation with the statement: "I cannot approve a proposed policy which requires the State to engage in an investigation of the causes of various diseases with which the human family is afflicted. I think that the interest of the people themselves

and the skill, intelligence and enterprise of physicians may be depended upon to make an investigation."

THE laboratory courses in biology at Wesleyan University will be conducted next year by Mr. Estin during the absence of Professor Conn in Europe.

THE Berlin correspondent of the London *Times* writes that, at the recent Medical Congress, Professor Liebreich, who may, perhaps, be described as the leader of the anti-Koch party in the Berlin scientific world, stated his theory of tuberculosis as opposed to Professor Koch's. Phthisis, he said, might be present without tuberculous bacilli as concomitants. The reception of tuberculous bacilli into the system had an injurious effect only in cases where there existed a predisposition to disease, and thus the bacilli were only parasites. It was a radically false method to attempt merely to deliver a consumptive patient from the presence of bacilli. The chief thing was to increase the vital power of the cellular tissue. Cantharidine was a specific capable of producing this result. Was there any method of disinfecting the cellular system? In Professor Liebreich's experience he found that etherized oil of mustard had this effect. The lecturer did not think that the therapeutic systems which had been built up on the basis of bacteriology were defensible. The results obtained with diptheritic serum were apparent rather than real. Professor Koch's method of treating tuberculosis had no prospect of ultimate success. Professor Liebreich's views were summarized in the sentence: "Tuberculosis is a 'nosoparasitism,' and the essential feature of the disease is the deterioration of the organism." Several subsequent speakers of eminence strongly combated Professor Liebreich's assertions, urging in particular the indubitable successes obtained with diphtheritic serum.

UNIVERSITY AND EDUCATIONAL NEWS.

THE Hull Biological Laboratories of the University of Chicago were formally dedicated on July 2d. The presentation was made by Miss Helen Culver and the acceptance acknowledged by the President. The dedicatory address was made by Professor William H. Welch, of the Johns Hopkins University, his subject being 'Biology and Medicine.' The laboratories were open to inspection in the afternoon. A dinner was given to the visiting biologists before Professor Welch's address and a reception was given afterwards by the members of the biological faculties to Miss Culver and Professor Welch.

THE University of Chicago will erect a new building outside the University grounds which will contain the plant for power, light and heat, the extensive printing and bookbinding establishment and a retail bookselling and stationery department.

THE trustees of the College of the City of New York have approved the purchase of a site on Convent Avenue, and have authorized the executive committee to select plans for the buildings.

PRESIDENT G. J. KOLLEN, of Hope College, situated at Holland, Mich., announced at the recent commencement that $100,000 had been subscribed for the College by various donors.

BY the will of the late Dr. John T. Atwater, of Poughkeepsie, N. Y., Yale University receives land valued at $25,000.

THE Ohio Supreme Court has handed down a decision that gives the Ohio State University the estate left by the late Mr. Henry F. Page, consisting of farms and personal property, the exact value of which is not known.

THE Thirty-fifth University Convocation of the State of New York met at Albany from the 28th to 30th of June, with a large attendance of those interested in higher education. Addresses were made by Chancellor Upson, Governor Black and President Canfield, of the Ohio State University. The first morning was devoted to the teaching of science, papers being presented on the 'Present Trend of Geography,' by Professor W. M. Davis, Harvard University; on 'Methods of Teaching Botany in the Secondary Schools,' by Professor Geo. F. Atkinson, Cornell University; on 'The Proper Use of Library and Laboratory in Teaching Physical Science in

the Secondary Schools,' by Professor John F. Woodhull, Teachers' College, New York; on 'The Practical Study of the Brain in a Primary School,' by Professor Burt G. Wilder, Cornell University, and on 'The Place of Electricity in the College Curriculum,' by Brother Potamian, Manhattan College. These papers were discussed by Professor A. P. Brigham, Colgate University; Professor E. L. Nichols, Cornell University; Professor W. LeConte Stevens, Rensselaer Polytechnic Institute, and others. Among other subjects considered by the convocation were Athletic and Oratorical Contests, Instruction in Ethics in Secondary Schools, The Relations of the College to the University and a National University, under which latter subject Professor R. H. Thurston, Cornell University, read a paper entitled, 'The National University and Technical Education.' In some remarks on the work of the University, Regent T. Guilford Smith called special attention to the work in geology and botany of Dr. F. J. H. Merrill and Mr. J. A. Lintner.

The New York State Teachers' Association met at the Normal College, New York, from June 30th to July 2d, with about 2,000 members in attendance. There was a nature study section in which papers were read on 'Nature Study in a Crowded City,' 'The Use of the Microscope,' 'The Mounting of Botanical Specimens,' 'Literary Aids,' and other subjects of interest to teachers of science in the schools. A State Society for Child Study was organized with Mr. George Griffith, of Utica, as President, and Professor M. V. O'Shea, recently elected professor of pedagogy at the University of Wisconsin, as Secretary and Treasurer.

Dr. Charles E. Beecher has been promoted to a University professorship of historical geology at Yale University, and Dr. L. V. Pirsson to a professorship of physical geology in the Lawrence Scientific School.

Dr. F. E. Hull, of Toronto University and the University of Chicago, has been appointed to the chair of physics in Colby University, vacant by the resignation of Professor William A. Rogers.

The following promotions and appointments have recently been made by the Trustees of the Johns Hopkins University: John M. T. Finney, M.D., now associate, to be associate professor of surgery; Lorrain S. Hulburt, Ph. D., now associate, to be collegiate professor of mathematics; James E. Humphrey, S.D., now lecturer, to be associate professor of botany; William J. A. Bliss, Ph.D., now assistant, to be associate in physics; N. Ernest Dorsey, Ph. D., now fellow, to be assistant in physics; William T. Mather, Ph.D., now fellow, to be assistant in physics; George B. Shattuck, Ph. D., now fellow, to be assistant in geology; Oliver L. Fassig, S.B., of the U. S. Weather Bureau, to be instructor in climatology; Charles R. Bardeen, M.D., to be assistant in anatomy.

Fellowships at the Johns Hopkins University have been awarded as follows: F. S. Conant, Zoology (the Bruce fellowship); Cleveland Abbe, Jr., Geology; G. A. Drew, Biology; C. W. Greene, Biology; J. G. Hardy, Mathematics; W. A. Jones, Chemistry; C. E. Mendenhall, Physics; S. A. Mitchell, Astronomy; J. L. Nichols, Pathology; E. E. Reid, Chemistry, C. W. Waidner, Physics. It appears that these awards represent four notable instances of heredity either of 'nature' or of 'nurture.'

The White professorship of moral philosophy at Oxford, vacant by the death of the late Professor Wallace, has been filled by the selection of Mr. John Alexander Stewart, tutor of Christchurch, and known as the editor of Aristotle's *Ethics*.

The allowance made from the public funds for the English University Colleges and for the College at Dundee has this year been increased from £15,000 to £25,000. On the recommendation of a committee, consisting of Mr. T. H. Warren, President of Magdalen College, Oxford, and Mr. G. D. Liveing, professor of chemistry, Cambridge, the apportionment has been made as follows:

The Owens College, Manchester.....	£3,500
University College, London.....	3,000
University College, Liverpool.....	3,000
Mason College, Birmingham.....	2,700
King's College, London.....	2,200
Yorkshire College, Leeds.....	2,200
Durham College of Science.....	2,200
University College, Nottingham.....	1,500

Firth College, Sheffield	1,300
University College, Bristol	1,200
Bedford College, London	1,200
University College, Dundee	1,000

DISCUSSION AND CORRESPONDENCE.

A PLEA FOR 'SCIENT.'

TO THE EDITOR OF SCIENCE: I wish to ask you not to use 'Scientist' in the pages of SCIENCE any longer, but to employ in its place the term 'Scient,' which is already well known in English in such compounds as 'omniscient' and 'prescient.' 'Scientist' appears to have been formed from 'Science' after the fashion of Artist from Art, but the 't' is an unfortunate intruder, and the better derivative would have been 'Sciencist.' But 'Scient' is shorter and much more correct. Moreover, it is the exact equivalent of the French term 'Savant,' which is frequently used in English also, but generally in a more or less derisive sense. Therefore, let us in future say 'Scient' (= 'sciens,' a man that knows) to which there is no possible objection, and which is already in frequent use in composition.

T. L. SCLATER.

ZOOLOGICAL SOCIETY OF LONDON,
June 23.

[It is easier to name a hundred species than to give currency to one obsolete word. The word 'Scientist' was introduced by the late Dr. B. A. Gould. It is not used in editorial contributions to this JOURNAL, but being a useful word, correctly formed (from *scientia; cf.*, scientific), it bids fair to outlive its ugly associations, perhaps more quickly in Great Britain than in the United States.—ED. SCIENCE.]

SHARPENING MICROTOME KNIVES.

SINCE Professor Minot has brought into prominent notice* Moll's method of sharpening microtome knives, it might be of interest to call attention to the fact that in an earlier paper† Moll describes a very useful part of the method which is not mentioned in the article cited by Professor Minot. It consists simply in the use of emery and water on plate glass to grind the knife into shape and to renew the edge when it has been injured in any way. After trying numerous abrasives, including the particular grades of emery used by Moll, I discovered that carborundum is by far the best for this purpose. It is so extremely hard and is supplied in such uniform grades* that it is possible after the knife has once been ground to shape to grind out a bad nick in a few minutes, which greatly minimizes the annoyances of cutting resistant tissues. After the edge has been smoothed as much as possible with the finest grade of carborundum, diamantine† is used as Professor Minot describes. Moll recommends using one side of the plate for grinding and the other for polishing the edge. To grind into shape the edge of a knife or razor as furnished by the manufacturer is a matter of considerable difficulty, and here in particular carborundum or emery is almost indispensable. Those possessing microtomes in which razors can be clamped will probably find it more convenient to obtain thick razors already ground to shape and with the superfluous part of the cutting edge removed, as advocated by Moll. Such razors, of good English manufacture, slightly hollow-ground, and having a cutting edge measuring about 14–16°, are sold by P. J. Kipp & Zonen, Delft, Holland, for $2.50. (A glass plate mounted on a wooden block for sharpening the same can be had for $1.25.) These razors are rigid, in this respect very different from the thin, very hollow-ground ones usually found on the market. They have an advantage over knives in being more easily handled, besides being cheaper and easier to protect from injury when not in use.

WALTER T. SWINGLE.

U. S. DEPARTMENT OF AGRICULTURE.

*SCIENCE, N. S. 5, No. 127, June 4, 1897. Pp. 865–866.

†Moll, J. W., Het slijpen van microtoom-nessem, Botanisch Jaarboek uitg. door het Kruidundig Genootschap Dodonaea te Gent. 3, 1891, 541–554. Pl. 15; with a French résumé, pp. 554–556. (Gent, J. Vuylsteke.)

*I have used the No. 2 Carborundum of the 'sizes' 220, 1 minute, 5 minutes and 10 minutes, supplied by the Carborundum Company, Monongahela City, Pa.

†No. 1 pour franchir of A. Guyot-Lupold, Locle, Switzerland.

SCIENTIFIC LITERATURE.

The Ancient Volcanoes of Great Britain. By Sir Archibald Geikie. London, Macmillan & Co., Limited. New York, The Macmillan Company. 1897. 2 vols., Imperial 8vo, with seven maps and many illustrations.

The title of this work is hardly commensurate with the scope of its subject-matter. Since the author's characteristic modesty has restrained him from giving it a name adequately expressing its magnitude and importance, he may kindly permit his readers to name it for him in full and call it more justly: A treatise on vulcanology exemplified chiefly by the ancient volcanoes of Great Britain. Such a treatise is needed. The time is come when the cumulative gains of our knowledge of volcanoes acquired during the last twenty years should be reckoned up and an account of stock taken, when bad assets should be sponged out and doubtful ones appraised at reasonable estimates. Nearly every branch of science needs a periodic overhauling and a revised statement of its general facts and principles in the light of its most recent advances. It is long since volcanic geology has had a satisfactory one. But it has one now at the hands of a master. The method of treatment, the logical order of the constituent parts, the arrangement of its wealth of material, are such as to enable the reader to see, as clearly as the present state of the science permits, the relations of parts to the whole and of facts to principles. The broader generalizations which have thus far been reached concerning the nature of volcanic action, its products and their modes of occurrence, are first stated. They are put forward briefly and conservatively, and no words are wasted in needless discussion. This presentation of the subject of vulcanism in general is the object of the first seven chapters, or Book I. The remainder of the work is a detailed discussion of the volcanic phenomena of the British Islands. The arrangement or plan of this discussion is doubtless the best one that could be selected. It begins with the most ancient, advances through the succeeding geological ages in their regular order, and ends with the most recent. The broader and more general facts laid down in Book I. are the guiding principles of this discussion, and the vast array of concrete facts becomes the foundation upon which the principles and generalizations repose. It will be interesting to glance, necessarily in the briefest manner, at the special points of interest in this work.

The first chapter is in the nature of a prelude or exordium preparatory for what is to follow. It points out what geologists of other countries might otherwise fail to realize, that the British Islands have peculiar advantages for this study because of the remarkable completeness of the geological record, the exceptionally full development of volcanic activity in nearly all geological ages, and the advantageous manner in which its results are exposed to view by denudation. American geologists may find difficulty at first in realizing this, but the author makes it certain. And so this little island, which would be buried half a mile deep in a fraction of the lava which swamps our northwestern States, proves to be as fruitful in material for the edification of vulcanology as it has been for the advancement of civil liberty and civilization. In the work at large we find such a wide range and variety of volcanic phenomena that the rest of the world is not likely to furnish many that are much more valuable, or that would materially affect the inductions drawn from those of Britain, though other regions may furnish occurrences which seem to be absent there.

The second chapter speaks of the causes of volcanic action. It is, therefore, a very short one, for alas! how little we know of those causes. Just here we are fortunately not concerned with the discussion of them, but merely with the way in which the author treats them. He says just enough to indicate his acquiescence in the contractional hypothesis, of which the extrusion of molten magmas within the earth is regarded as a concomitant. Conjoined with this is the intense elastic or explosive force of the vapors occluded in those magmas and which we see escaping from them during the act of eruption. The causes of volcanic action constitute the darkest and most discouraging problem in physical geology, with the exception of the causes of regional elevations, which may perhaps be only another phase of the same mystery.

To a wise and prudent man no chapter could be more embarrassing and disagreeable to write than this one. In truth, the science has no newly established inductions to record which help to solve this mystery. It is just where it stood twenty years ago.

But if the second chapter is unsatisfactory by reason of the obduracy of the subject and the lack of progress to announce, the third and fourth chapters are the reverse. In these are described the materials brought by eruptions to the surface and their modes of occurrence. Along this line there has been great and rapid progress and our knowledge is fast taking shape. Since the time of Sorby the petrographer's microscope has yielded a world of knowledge of the constitution of rocks and opened the way to the solution of many questions. The field observation of erruptive material has also become more accurate and discriminating. The author's treatment of the whole subject, though brief and much condensed, is admirable. The field geologist of long experience among the volcanics will keenly realize the practical and accurate way in which every important feature is described and its significance interpreted. As we read it, it all seems simple enough. But it is that simplicity which is the result of great knowledge and experience, clarified by many years of laborious thought and frequently revised expression of it in writing. Especially gratifying is the broader or primary basis of his classification of the lavas. It is the strictly chemical one and there should be no other. In fact, most geologists have now adopted it by common consent. The classification by contained minerals and texture can only be secondary and subsidiary. In the earlier stages of microscopic petrography there was an apparent tendency on the part of many able investigators to make everything turn upon mineral contents and it proved to be a serious clog upon the results of their researches. New facts in extraordinary abundance, and many of them of high import, were brought to light, but the methods of grouping them often selected rendered them barren of generalizations. It is a matter of vast importance how we group volcanic rocks, for it profoundly influences the directions and limitations of our speculations concerning their genesis and primitive condition within the earth. The descriptions of the rock textures, their appearance to the naked eye and in the microscope, and the explanations of the terms which are commonly used to designate their many varieties, are all excellent and the examples well chosen. The descriptions of lava sheets follow. The clastic volcanic materials, conglomerates, agglomerates, tuffs and volcanic dust are given careful and accurate attention. The finer material is worthy of especial study in this country, where it has not hitherto been followed up with the diligence it deserves.

The fourth chapter is devoted to the especial consideration of materials errupted at the surface and to the types of volcanic piles, three types being taken, the Vesuvian, the Plateau or fissure and the Puy types.

The fifth chapter deals with the underground phenomena, the vents themselves and the necks or cores left in the passageways of the lavas to the surface being described with great fullness. It is a favorite theme of the author and he invests it with the liveliest interest.

The next, or sixth, chapter treats of dykes and the subterranean intrusive masses in the forms of laccolites and sheets of lava forced in between sedimentary beds. Finally he discusses those remarkable and singularly interesting intrusions named bosses, which are often so puzzling and hard to understand and which look as if a vast mass of relatively soft or plastic material had been trying to punch an immense hole or passageway upwards through hard, rocky strata and at the same time to preserve its identity and general shape with comparatively little deformation. This paradox is often seen in our Western mountains and is the problem of the so-called dome structure and eruptive granite of California and Colorado.

The remainder of the work, and much the greater part of its bulk, is a detailed description of the volcanic relics of the British Islands. It begins with the eruptions of the Archæan and ends with those of the Tertiary. The whole mass of material is arranged so as to constitute a geological history of vulcanism and also so as to show it in its relations to the geological evolution of the land. It is not light reading and is not a study for children. But to the ex-

perienced it is of profound interest from beginning to end. Each geological age is made a chapter, or series of chapters, by itself and is prefaced with a short, clear exposition of the general geology of that age as represented in the British formations, thus preparing the way to the easiest understanding of the relations of the volcanics to the geology at large. The first one will be of deep interest to all geologists, and to many it will be the most fascinating. For it treats of the pre-Cambrian rocks and the mystery of the 'fundamental complex.' In a few paragraphs he sketches in outline the state of knowledge of the rocks which underlie the oldest known sediments of Britain. Here, at the uttermost bounds of geological knowledge and in the dim light of the earliest known order of things, we find remnants of volcanic action. The admirable studies of Teall among the Lewisian or 'fundamental' gneisses of Murchison, exposed in the northwest of Scotland and in the Hebrides, leave little doubt that the great bulk of them are plutonic igneous rocks. They differ in no essential respect from those deeply buried bosses or intrusions of later ages which are known to be connected with surface eruptions and constitute the subterranean portions of the outflowing masses. But beds clearly contemporaneous and erupted at the surface have nowhere been identified, and interbedded clastic volcanic formations are also absent. On the other hand, the Archæan complex is traversed by innumerable dykes, which are certainly older than the oldest rocks which overlie the complex, and their volcanic nature is unmistakable. It is interesting to compare this with the conclusions reached by American geologists in the 'basement complex' of Canada and Lake Superior, where the facts are of the same nature and the conclusions are the same, except that surface eruptions both massive and clastic are recognized in abundance.

Sir Archibald still retains the name 'Lewisian gneiss' as originally given by Murchison. Why have our geologists been so shy of the good old name, Laurentian, given by Logan? Certainly a rose by any other name will smell as sweet, but what is the use of the other name? The extreme caution and candor of Irving (R. S.) were lovable, but they did not call for a new one. The old one would have misled nobody unless the true spirit of geology were not in him. All needful reservations geologists will make for themselves.

In the same chapter the reader is carried up into the vast pre-Cambrian formations which overlie the Lewisian, from which they are divided by the great unconformity, probably the greatest in all geological time, and to the first great series the name of Torridon sandstones is given. They abound in dykes, intrusive sheets (or 'sills') and bosses, but no surface eruptions have been proven. Higher still after another great unconformity is a vast succession of crystalline schists (provisionally named Dalradian) whose age is not yet determined, but which seem in part at least to be pre-Cambrian. They too abound in eruptives and their general character suggests our own Algonkian rocks. It is obviously impossible here to note in detail the substance of the long series of chapters which carry the reader from the Archæan to the close of the Palæozoic. Only the most general summary can be given. And yet to pass thus cursorily over the many chapters relating to the eruptive masses of the Cambrian, the Silurian, the Old Red Sandstone, and, above all, the long series of chapters devoted to the Carboniferous, with all their wealth of material wrought out in such a masterly way, seems unappreciative. We are presented with an immensely long vista of volcanic action, beginning with the earliest epoch of which we have any knowledge and extending down to the close of the Palæozoic, manifesting itself in all that succession of ages. But the more ancient they are the more profoundly have the erupted materials been changed or modified by metamorphic action and disturbed by repeated earth movements with dislocations and distortions of the strata, so that the determination of their true volcanic nature has required many years of labor by hundreds of earnest workers in the field and laboratory and with the microscope. The result of this labor now seems well assured, not only in Britian, but in all other countries where geologic research is diligently prosecuted. One grand result of it is the conclusion that volcanic action has been the same in all ages. And when our thoughts reach

back to the Archæan we find that even then the world was an old world. Nor are there any visible signs that the world was then any nearer the beginning than it is to-day. Geology has thus far found nothing to tell us about the beginning of mundane things, and our notions of a primordial state of the world must come wholly from outside the domain of geology.

With the close of the palæozoic came a long age of quiescence in volcanic action. No traces of it have been discovered in any part of the Mesozoic of Britain, and only trifling ones in the Mesozoic of all Europe. But though the fact is a wide one, it is not world-wide. The eruptive masses of our own Appalachians, New England and Nova Scotia are Jura-Trias, and the vast fields of the Deccan in India are assigned to the Cretaceous. That they should have slumbered so long in Europe is remarkable, but still more so is the fact that their fires should have been awakened again with full energy in the Cenozoic and often in the same old places.

The description of the Tertiary eruptions of Britain is the theme of the greater part of the second volume. It is of especial interest to American geologists whose labors have been most largely in the far West, where the main eruptive masses are distributed all the way from early Eocene down to a time which is surely post-Glacial. The chapters on these rocks are a veritable mine of information. Remarkable indeed are the two chapters on the Tertiary dykes not only on account of the extraordinary development of these features in the island of Great Britain, but equally so on account of the thorough manner in which they have been worked up in the field and in the laboratory. Of course, it represents the labor of many investigators for several generations, but among them we know that our author is preeminent. He draws an interesting inference from them. While accepting the physicist's view of the general solidity of the earth as a whole, he concludes that during the Tertiary volcanic period not less than 40,000 square miles of Britain were underlaid by one or more reservoirs of liquid lava. This state of affairs he puts into relation with a discussion as a pure mechanical problem by Hopkins, in 1835, where just such conditions were assumed. The inferred result was the formation of fissures similar in form and grouping to those which field observation discloses.

The chapters on basaltic plateaus constitute the most conspicuous subject connected with the Tertiary eruptions. Assuredly the grandest results of volcanic action the world over are the plateau eruptions. Great piles like Shasta and Ætna, however imposing, are after all secondary in importance. The plateau eruptions of Great Britain, their extension into the far North to the Faroe Islands, and their possible connection with those of Iceland, are a grand theme and the descriptions of them are worthy of the subject. In the author's mind these plateau eruptions often take the form of the so-called fissure type as distinguished from the centralized vent, and the dykes as described in preceding chapters are regarded as the relics of fissures supplying the lavas of plateaus which have been swept away by secular erosion. In view of the great importance attached to the massive eruptions from fissures he introduces an interesting sketch of the lava fields of Iceland, which are believed to furnish the most impressive examples of recent occurrence.

American geologists will take a lively interest in the chapters which follow, describing the intrusive Tertiary rocks, especially the olivin-gabbros and the eruptive granites. We have them in this country and they have awakened warm discussions as to their real nature. Their true eruptive character is now beyond dispute, and their occurrence in Tertiary time is an important consideration in establishing the practical identity of volcanic action in the most ancient and most recent ages. The British examples are certainly admirable ones and are described with the author's usual precision and clearness.

It seems like trifling with a serious subject to merely notice in this fragmentary way a few points in this great work, which abounds in an unspeakable wealth of instructive and interesting material, all wrought out and delineated with a master hand. The arrangement is admirable. Everything is in logical order, and whatever precedes is a preparation for that which follows. The broad plan of the work is historic progression, and as we complete the

perusal we can look back through 'the corridors of time' and admire the perspective with everything in due proportion.

I regard this monograph as the greatest work on vulcanology ever written. Scrope's work on the volcanoes of central France was indeed a great one—almost an epoch-making one in its day. Nor is its force or usefulness yet spent. For it may be still read with great profit and instruction. But it was much more limited in its categories and discoursed upon the volcanoes of a single period. The work before us deals with vulcanism in all its aspects and with volcanoes of all time, and embraces a vast accumulation of knowledge, of which the world in Scrope's time knew little or nothing.

C. E. Dutton.

Catalogus Mammalium tam viventium quam fossilium. By Dr. E. L. Trouessart. Berlin, R. Friedländer & Sohn. January, 1897. 2d ed., fascic. I., Primates, Prosimiæ, Chiroptera, Insectivora. 8°, pp. 218.

The appearance of the first part of the new edition of Trouessart's 'Catalogue of Mammals, Living and Fossil,' will be welcomed by all students of mammals, for such compilations, in spite of their inherent imperfections, are a great practical convenience.

The present part contains 265 genera and 1,294 species, which numbers, contrasted with those of the first edition (1878–81), show a falling-off of 104 genera and an increase of 200 species. The decrease in genera seems to be due in the main to different limits assigned to the orders, chiefly from the shifting of fossil genera.

The work is apparently brought down to the end of 1896, as it includes *Nesopithecus* Forsyth Major (published in October, 1896) and recent species described by Thomas. For fossil forms Rogers's 'Verzeichniss' and Lydekker's 'Geographical History of Mammals' have been consulted. Five new generic and subgeneric names are proposed, as follows:

p. 17. *Rhinostictus*, based on Sclater's *Cercopitheci rhinosticti* 1893.

p. 19. *Erythrocebus*, based on Sclater's *C. erythronoti.*

p. 22. *Otopithecus*, based on Sclater's *C. auriculati.*

p. 68. *Prosinopa* for *Sinopa eximia.*

p. 204. *Scaptogale* for *Echinogale* Pomel 1848, preoccupied.

The usual sequence of forms is reversed, the Catalogue opening with the genus *Homo*, which, by the way, is given independent ordinal value ('Ordo I. Bimana') in accordance with the antiquated Cuvierian system. *Pithecanthropus* is recognized as a valid genus—the highest anthropoid—and is the first genus given under Primates. The Lemurs are raised to ordinal rank. The classification adopted is in the main that of Flower and Lydekker (except that it begins at the wrong end), but we regret to see that Lydekker's excellent division of the old order Edentata into *Edentata* (Armadillos, Anteaters and Sloths) and *Effodientia* (Pangolins and Aard-varks) is not followed.

The matter is so arranged that the specific names, references and synonymy form a broad column on the left-hand side of the page, while the geographic distribution occupies a narrower column on the right. Unfortunately, the type localities are not given at all. The specific names are numbered consecutively and are printed in black-face type; the subspecific names are not numbered and are in italics. 'Varieties' are preceded by '*Var.*' but the author neglects to state how he imagines a 'variety' to differ from a subspecies. Synonyms are indistinguishable from the recognized subspecies, except that they lack the letter and dash [a.—] which precede the former—a hardly sufficient distinction.

By this method of treatment the distinction between species and subspecies is greatly exaggerated—a common error among authors whose knowledge of the forms treated is derived mainly from books rather than from specimens. Whether the describer of a new form accords it specific or subspecific rank depends, according to present usage, on his belief as to the existence or non-existence of intergrades connecting it with other forms, and his views on this subject are pretty sure to vary with the material at hand and the time spent in its study, and sometimes with his mood and the particular day his manuscript goes to press. Hence it is not surprising that an author often changes his attitude with respect to the status

of a particular form, treating it as a subspecies in one paper and a full species in the next. In the case of the Texas mole described as a subspecies by Dr. J. A. Allen in 1891 and raised to specific rank by the same author in 1893, Dr. Trouessart adopts a curious course. He gives it as a full species with 1893 as the date, and then in synonymy gives the subspecific form in which it was originally described, with 1891 as the date, showing that he was aware of the correct date. Of course, the species should date from 1891—the year in which *the animal* was named—for the date on which an author happens to change his mind as to the *rank* of a particular form has nothing to do with the date of the name. If this case represents Dr. Trouessart's views in this matter the inference is that he, like some botanists of the old school, is a worshipper of the 'combination.' He certainly agrees with these botanists in spelling personal and some other specific names with a capital initial letter—in this respect again departing from the best usage among zoologists.

Sections of genera and forms of species of earlier authors are sometimes given formal subgeneric and subspecific names, and names so given are credited to the early author instead of to himself. Thus the section 'Cercopitheci Rhinosticti' of Sclater is made the subgenus '*Rhinostictus* Sclater,' and Dr. Harrison Allen's 'Var. (b) Northern form of Vespertilio gryphus' is made 'Var. *septentrionalis* H. Allen.'

I am indebted to Dr. T. S. Palmer for calling my attention to Dr. Trouessart's extraordinary rule for the treatment of preoccupied names. If he finds such names preoccupied among mammals he promptly renames them (as *Scaptogale* nob. for *Echinogale* Pomel), but if they are preoccupied in other branches of the animal kingdom he lets them stand. Thus the generic names *Tylostoma* (p. 155), *Schizostoma* (154), *Macrotus* (152), *Mystacina* (149), *Furia* (135), *Vesperus* (106), *Megaloglossus* (98) and many others are retained, notwithstanding the fact that all are preoccupied and replaced by other names now in more or less common use. A few of the dates given for genera are erroneous. For instance, *Leuconoe* Boie '1825' should be 1830, and *Dendrogale* Gray '1843' should be 1848. *Prototalpa* is evidently an amended form of *Protalpa* and as such should date from *Prototalpa* Roger 1887 instead of *Protalpa* Filhol 1877.

Since the appearance of the first edition of Dr. Trouessart's Catalogue (1878–85) no attempt has been made to collect in one work the names of all the mammals of the world; and since all fossil as well as living species are included, the immensity of the task is apparent. Most authors shrink from such an undertaking, not only on account of its magnitude, but also on account of the extreme difficulty, not to say impossibility, of determining the status of described forms in groups that have not been recently revised. Nevertheless the work is of such great practical utility that for years to come every student of living or fossil mammals must keep a copy at his elbow and will owe its author a debt of gratitude. Dr. Trouessart is evidently a very rapid worker; we wish him health and freedom from interruptions, so that his great undertaking may be speedily completed.

C. H. M.

SOCIETIES AND ACADEMIES.

THE 96TH REGULAR MEETING OF THE CHEMICAL SOCIETY OF WASHINGTON.

THE following program was presented:

H. N. Stokes: 'The Chloronitrides of Phosphorus.' P. Fireman: 'The Ripening of Cheese and the Rôle which Micro-organisms Play in the Process.' E. A. de Schweinitz and Marion Dorset: 'The Product of the Tuberculosis Bacillus.' H. W. Wiley and W. H. Krug: 'The Standard Methods of Starch Determination.' W. H. Krug and J. E. Blomén: 'The Commercial Preparation of Nitro-napthalene.' F. K. Cameron: 'The Replacement of Chlorine by Sulphur in Alkaline Chlorides.' Wirt Tassin: 'A New Mineral.'

Dr. Stokes showed that the only members of the phosphorus Chloronitrides series $(PNCl_2)_n$, hitherto known are $(PNCl_2)_3$ (Liebig) and $(PNCl_2)_4$ (Stokes). The series is now extended to include $(PNCl_2)_5$, $(PNCl_2)_6$ and $(PNCl_2)_7$, as well as a mixture of higher polymers, not yet isolated, and terminating with a rubber-like polymer of high molecular weight. The substances are prepared by heating equimolecular weights of phosphorus pentachloried

and ammonium chloride in sealed tubes, whereby a mixture of chlorides in nearly theoretical amount is obtained. This is distilled from the open tube and afterwards submitted to careful fractional distillation *in vacuo*. The unique feature of the series is found in the fact that any member can be converted into the rubber-like polymer by heating, and that the latter, on distilling at a higher temperature, breaks down quantitatively into a mixture of all the lower members; it is, therefore, possible ultimately to convert any member completely into any other by heating and distilling alone. The lower members, up to and including $(PNCl_2)_6$ are well characterized, finely crystallized bodies, while $(PNCl_2)_7$ is liquid. Their stability diminishes with increasing molecular weight, $(PNCl_2)_3$ being unattached by boiling alkalies, while the rubber-like polymer is destroyed by boiling water. The formation of $PNCl_2$ and $(PNCl_2)_2$ could not be detected. The chloronitrides constitute the first extended series of inorganic polymers interconvertible by simple and direct means.

Dr. Fireman gave an extended résumé of the work of Duclaux and others showing that the lactic acid producing bacteria are not so important in the production of butter flavors as are the peptonizing bacteria.

Drs. de Schweinitz and Dorset stated that in studying the products of the growth of the tuberculosis bacilli in artificial media, it was noted that the reaction of the cultures usually becomes acid, and as Prudden and Hodenpyl had succeeded in producing tuberculous nodules without necrosis by the intravenous injection of dead bacilli, it seemed as though it should be possible to isolate from cultures of tuberculosis bacilli an acid substance, which is responsible for the necrosis of tissue that always takes place in this disease. After many fruitless attempts they succeeded in isolating from artificial cultures a crystalline acid substance having a melting point of 161° to 164° C. which was soluble in ether, alcohol and water, and crystallized in needle-like prisms. The solution of this substance was optically inactive and did not give the biuret action. The preliminary analysis of this substance gave a formula, like that of teraconic acid and the other properties correspond closely with this acid. Its identity if such has not yet been proved. When injected subcutaneously into guinea pigs it causes a slight inflammation and localized necrosis, and injected directly into the liver tissue by means of a hypodermic syringe it produces characteristic necrosis. The substance causes a reduction of temperature in tuberculous animals, and it seems probable that we have here the material which is responsible for the necrosis in tubercular infection.

Dr. Wiley and Mr. Krug showed that various methods depending on the polarization of the starch or its inversion products, as well as others based on direct weighing of the starch, were too inaccurate to commend themselves to the analyst. The only accurate methods depend on the eventual inversion of the starch into dextrose, which is then estimated by Allihn's method. Experiments in the preparation of the Nitro-naphthalenes showed that they can not be prepared from α-naphthalene sulphonic acid, but that the best yield is obtained with mixtures of nitric and sulphuric acids. The best results were obtained with 30° B. nitric acid, using about three times as much acid as naphthalene. The amount of sulphuric acid, used varies with the nitration degree desired, varying from 4 : 1 (nitric : sulphuric) for low melting products to 3:2 for the higher derivations.

Dr. Cameron cited some of his own experiments to show that, although it is possible in the case of some heavy metals to replace chlorine by sulphur by merely boiling the latter with a solution of the chloride, it is impossible to obtain such a reaction with alkaline, or alkaline earth chlorides even upon heating in sealed tubes at a high temperature.

Mr. Tassin gave a short description of a new mineral, but reserves the details for special publication.

V. K. Chesnut.
Secretary.

TORREY BOTANICAL CLUB, MAY 26, 1897.

The President, Hon. Addison Brown, presided. The evening was devoted to a lecture by Mrs. Elizabeth G. Britton, entitled 'The

Moss Flora of the Adirondack Mountains,' illustrated by lantern-slides prepared by Mr. C. H. Van Brunt, and also by numerous mounted specimens. These specimens, comprising about 150 sheets, handsomely displayed about the walls of the lecture-room, represented collections made by Mrs. Britton in the vicinity of Adirondack Lodge and Lake Placid in the years 1892, 1894 and 1896. The various locations where these mosses grew were described, including the story of a climb up Mount Whiteface. Graphic bits of description of these mosses brought out salient points as the slides indicating their structure were exhibited, and these were accompanied by numerous slides illustrating the scenery of their habitat. Among about 30 rare species enumerated were *Raphidostegium Jamesii*, not previously reported for New York State, and *Bryum concinnatum*, found only once before in the United States. Duplicates of Mrs. Britton's collection have been deposited at the State Herbarium at Albany, the main collection having been presented to the Herbarium of Columbia University. Partial sets were sent to the Brooklyn Institute, to Cornell University and to various other collections.

The subject of the lecture was further discussed by Mr. A. P. Grout and by Mrs. Britton, after which the Club adjourned to the second Tuesday in October, field meetings continuing meantime on Saturdays.

EDWARD S. BURGESS,
Secretary.

SCIENCE CLUB OF THE UNIVERSITY OF WISCONSIN.

MR. EDWARD KREMER discussed 'The Periodic System.' The speaker introduced his subject by giving a brief account of the earlier attempts to refer back to a prime matter the manifold forms in which material nature reveals herself to man. This line of thought was briefly traced from the early Greek philosophers to Prout. The reaction that followed Prout's hypothesis was duly emphasized. The lack of interest in Doehereiner's trials, and the modifications of these trials by others, in Newland's octaves, in Lothar Meyer's first chart it was thus explained in large part. Attention was also called to the fact that the principal interests seemed to center about the numerical relation existing between the atomic weights of the elements and that the time value of the system was not duly appreciated until this was made secondary to the natural classification of the elements according to their physical and chemical properties. Incidentally the prediction by Mardelejiff of the existence of certain elements and their discovery by others were alluded to, because with the discovery of their elements the natural law gained more general favor. What the periodic law really is was strongly emphasized, also the fact that the present arrangement of the elements according to this law is imperfect, but more recent systems were not discussed, partly for want of time. Finally the great advantage to be gained by using the periodic law as the basis for teaching advanced chemistry was demonstrated

C. S. SLICHTER reviewed Larmor's 'Theory of the Ether.' He first gave an explanation of the vortex theory of matter, including the properties of vortex rings and their mode of linking, and kinds of vibration. Hill's spherical vortex was explained by a diagram, and the possibility of building up a rotationally elastic ether from such cells was explained. Photographs of sandstone showing turbulent motion were presented for the purpose of showing the character of their structure. The intrinsic energy of the ether, radiation, action at a distance, density and inertia of common matter were then discussed, closing with a new theory of gravitation. Mr. Quantz gave the results of work on the psychology of rapid reading. They were the results of a statistical study of the mental habits and characteristics of fifty university students, showing that rapidity of reading depends chiefly upon the following factors, given in the order of their importance: (*a*) quickness of visual perception; (*b*) practice, as measured by extent of reading from childhood up; (*c*) power of mental concentration; (*d*) absence of motor-mindedness (lip movement in silent reading); (*e*) rapidity of mental operations in general; (*f*) strongly developed eye-mindedness; (*g*) scholarly ability, as determined by class study.

WM. S. MARSHALL,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of the Academy of Science of St. Louis on the 7th of June, 1897, twenty-one persons present, Mr. Robert Combs, of Ames, Iowa, presented a paper entitled 'Plants Collected in the District of Cienfuegos, Province of Santa Clara, Cuba, in 1895–1896.' The paper embraces the results of a collection extending from the commencement of the rainy season of one year until the close of the dry season the following spring, the territory covered by the collection lying between the entrance of the Bay of Cienfuegos, on the south coast of Cuba, up the bay and the river Damuji to Rodas, and extending back from the river to Yaguaramos and almost to the Cienega de Zapato, a region including nearly all kinds of soil and conditions found upon the island, except those of the mountain regions and the mud swamps. A brief statement was made concerning the origin of the Cuban flora and its affinities with that of continental Central America, rather than the geographically nearer Floridan region.

The paper comprised a full catalogue of the collections made, which had been determined at the herbarium of Harvard University, and of which several sets had been distributed to the larger herbaria.

Professor F. E. Nipher made some remarks on the difficulties yet involved in the theories of the ether.

William Trelease.

THE TEXAS ACADEMY OF SCIENCE.

At the annual meeting of the Texas Academy of Science, held in the chemical lecture room of the University of Texas, June 15th, the following papers were presented:

'The Personality of a Great Genius—Sylvester,' by Dr. George Bruce Halstead, in which the author took occasion to point out the exalted position of the higher pure mathematics and to give his estimate of Sylvester—his old friend and teacher—as a mathematician.

'Epsom Salts, Magnesium Sulphate, from Brown county, Texas,' by Dr. H. W. Harper. The occurrence of Epsomite in large quantities in Brown county, and of a purity sufficient to make it the source of an exceedingly cheap commercial product, was here announced for the first time. Dr. Harper's analyses gave the following results:

Water	40.07	40.00
Silica	21.075	21.43
Alumina and Iron Oxides	2.20	2.21
Magnesium Oxide	12.381	12.38
Calcium Oxide	trace.	
Sulphur Trioxide	24.014	24.01
	99.74	100.03

Calculated to contain 76.13 % $MgSO_4.7\,H_2O$.

A series of experiments demonstrated that the crude material yields crystallized $MgSO_4$ within one or two % of the analyticai results.

'Some Texas Oil Horizons,' by Hon. E. T. Dumble. The Oil Horizons in Texas range from the Carboniferous to recent formations. I. The lowest horizon in the State is in the Bend division of the Carboniferous—the black shales of the Colorado river near Brownwood. They are apparently a continuation of the asphalt deposits of Indian Territory, as indicated by the finding of similar fossils. II. The lower beds of the Cretaceous—the Trinity Sands—in Jack, Montague and Burnett counties. III. The Eagle Ford Shale (Benton) of the Cretaceous, as, for example, in the well at Fiskeville, which furnished a little oil, and in the railroad cut south of Austin, where, it is said, the shale will burn. IV. The Black Marls of the Black Waxy Prairie Division of the Cretaceous. The well at Corsicana encounters at 1,040 feet a 15-foot oil sand. Oil will also be found eastward to Smith and Anderson counties. V. The Nacogdoches horizon, which seems to be the eastern appearance of the oil and asphalt deposits of California.

'Pedagogical Note on Mensuration,' by Professor Arthur Lefevre.

'The Texas Permian,' by W. F. Cummins (read by title).

'On the Bio-Geography of Mexico and the Southwestern United States,' by C. H. Tyler Townsend (read by title).

The following officers were elected for the ensuing year: President, Dr. George Bruce Halsted: Vice-President, Professor T. U. Taylor; Treasurer, Hon. E. T. Dumble; Secretary, Professor W. W. Norman.

Frederic W. Simonds.